PB81-248841

Review and Update of Modeling Analysis of Carbon Monoxide Emissions in Mecklenburg County, North Carolina

Engineering-Science, Inc.
McLean, VA

Prepared for

Environmental Protection Agency
Atlanta, GA

Jul 81

U.S. Department of Commerce
National Technical Information Service
NTIS

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. 904/9-81-080	2.	3. Recipient's Accession No. PB81 248841
4. Title and Subtitle Review and Update of Modeling Analysis of Carbon Monoxide Emissions in Mecklenburg County, North Carolina			5. Report Date July 1981 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Engineering-Science 7903 Westpark Drive McLean, Virginia 22102			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) [redacted] (G) 68-02-3509
12. Sponsoring Organization Name and Address USEPA, Region IV 345 Courtland St., N.E. Atlanta, Georgia 30365			13. Type of Report & Period Covered Final Report 14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

An updated technical analysis of the carbon monoxide emissions was conducted using the state-of-the-art modeling techniques. The techniques, once calibrated with the measured concentrations, were used to forecast ambient CO concentrations at three existing monitoring sites as well as at other anticipated "hotspots" where high concentrations might occur. The results of the analysis indicates four locations where ambient violations may occur at the end of 1987. The results of this analysis will be used to compile a control plan for the scheduled State Implementation Plan Revision in 1982 which will be able to show these hotspots in compliance with the ambient standard by the end of 1987.

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

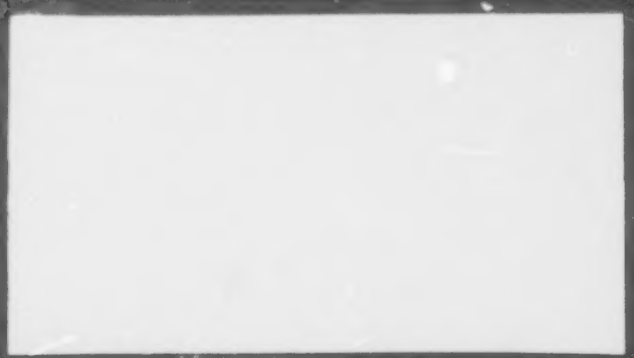
18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
	20. Security Class (This Page)	22. Price

(See ANSI-Z39.18) See Instructions on Reverse

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

2<

PB81-248841



ENGINEERING-SCIENCE
DESIGN • RESEARCH • PLANNING
7903 WESTPARK DRIVE • McLEAN, VIRGINIA 22102 • 703/790-9300
OFFICES IN PRINCIPAL CITIES

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

REVIEW AND UPDATE OF MODELING ANALYSIS OF CARBON MONOXIDE EMISSIONS IN MECKLENBURG COUNTY, NORTH CAROLINA

Contract 68-02-3509
Work Assignment No. 5

Prepared for

U.S. Environmental Protection Agency
Regio IV
345 Courtland treet, N. E.
Atlanta, Geo gia 30308

July 1981
9205.00/75

Submitted by

Engineering-Science
7903 Westpark Drive
McLean, Virginia 22102

TABLE OF CONTENTS

CHAPTER 1	INTRODUCTION	1-1
CHAPTER 2	SUMMARY AND CONCLUSIONS	2-1
CHAPTER 3	SUMMARY OF MONITORING DATA	3-1
	CO Monitoring Data	3-1
	Meteorological Data	3-1
CHAPTER 4	MODELING PROCEDURE	4-1
	Model Selection	4-1
	Traffic Data	4-2
	Meteorological Considerations	4-2
	Modeling for Peak 8-Hour Concentration	4-3
	Background Concentration	4-4
	Model Validation	4-4
CHAPTER 5	PROJECTED AIR QUALITY	5-1
APPENDIX A	DAYS WITH HIGHEST OBSERVED CO CONCENTRATIONS	
APPENDIX B	DETAILS OF IMM-6 MODEL	
APPENDIX C	TRAFFIC DATA FOR MONITORING SITES	
APPENDIX D	SAMPLE IMM-6 PRINTOUTS	
APPENDIX E	ADDITIONAL HOT SPOT ANALYSIS	

LIST OF TABLES

3.1	Summary of Measured CO Concentrations	3-2
3.2	Monthly Summary of CO Concentrations in 1980	3-3
3.3	Surface Weather Observations for Charlotte, NC - December 5, 1980	3-5
3.4	Surface Weather Observations for Charlotte, NC - December 6, 1980	3-6
3.5	Mixing Heights for Charlotte, NC - December 4-6, 1980	3-7
4.1	Comparison of Predicted vs. Measured Concentration	4-6
4.2	Traffic Parameters for Three Monitoring Sites	4-7
5.1	Predicted Air Quality	5-2

4<

CHAPTER 1

INTRODUCTION

In compliance with the Clean Air Act (CAA) as amended in 1977, Mecklenburg County of the Charlotte Metropolitan area was designated nonattainment for carbon monoxide. For areas designated as nonattainment, the Act requires that the States revise their State Implementation Plan (SIP) to attain the air quality standards as expeditiously as possible. The achievement of the standards in general is required by December 31, 1982. However, for carbon monoxide and ozone a five-year extension to 1987 can be granted. This extension is contingent upon a demonstration that attainment is not possible by 1982 despite implementation of all reasonable control measures. The Act further requires that the SIPs for those areas not achieving the standards by 1982 include a program of automobile Inspection and Maintenance (I&M) in 1982.

Subsequently, the State of North Carolina submitted a revision of their SIP which predicted attainment of the CO standards in Mecklenburg County by 1987. The Plan included air quality benefits of a proposed automobile I&M program. The need and the air quality benefits of the I&M program were based on a technical analysis performed in mid-1978. Since the air quality analysis was prepared nearly three years ago under a compressed time schedule, it is now necessary to revise the analysis using up-to-date information and state-of-the-art modeling techniques.

Consequently, Engineering-Science (ES) has been contracted by the U.S. Environmental Protection Agency (EPA) Region IV to study the potential for attainment of the CO standards in Mecklenburg County.

The study was carried out in two phases. The first phase of the study focused on a detailed air quality analysis for the three existing monitoring sites in the area. Modeling analyses for CO concentrations at the monitoring sites were performed for the year 1980 and predicted concentrations were compared with measured concentrations to determine the validity of the modeling procedures used. The modeling procedures were then applied to determine the air quality levels for carbon monoxide in future years at these monitoring sites.

In the second phase of the study, the potential for attainment of the CO standards at other anticipated hot spots in the area was investigated. Hot spots are defined as locations where ambient CO concentrations exceed the ambient air quality standards (AAQS). The carbon monoxide standards are 35 ppm 1-hour maximum and 9 ppm 8-hour maximum, neither of which are to be exceeded more than once per year. Air quality monitoring data are considered to provide sufficient information to determine whether an area

is in compliance with the standards. However, recent studies have shown that CO hot spots can be more widespread than is indicated by the existing monitoring networks, since there are a limited number of sites measuring CO and these sites are not always the most desirable in identifying the maximum concentrations to which the public may be exposed. Consequently, various procedures are used to identify potential hot spots.

A preliminary assessment of CO hot spots was performed by the Technical Coordinating Committee (TCC) of the Mecklenburg County in close cooperation with the Charlotte-Mecklenburg Transportation Advisory Committee (TAC). The scope of this preliminary analysis was to identify the potential hot spots on the basis of street configuration and traffic congestion. From this analysis a selected number of intersections were identified for further study. Using an approved air quality dispersion model, carbon monoxide concentrations were computed for these sites for the year 1983. The computed concentrations were compared with the Standards to determine whether these sites were potential CO hot spots. The model was again used to quantify the expected CO concentrations in 1987 at the potential hot spots. The air quality benefits to be derived from implementation of automobile inspection and maintenance programs were also quantified. The results of this analysis provide a more realistic estimate of future CO levels in the area.

CHAPTER 2

SUMMARY AND CONCLUSIONS

1. ES conducted a study of projected carbon monoxide levels in Mecklenburg County. Of primary concern was the potential for attainment of the CO standards in 1987.

2. Ambient air quality monitoring data were reviewed to determine the extent of violations of CO standards during the period from 1978 to 1980. The review indicated that there were no violations of the 1-hour CO standard, but the 8-hour standard was violated on several occasions during the period.

3. A review of available traffic and dispersion models was made in order to select an appropriate model for the analysis. Based on this review the Intersection-Midblock-Model (IMM) was chosen. The model was updated to include the latest automobile emission factors (MOBILE-2) as published by EPA.

4. Detailed air quality analyses were performed for each of the three monitoring sites. The results indicate potential for violation of NAAQS for CO in 1987 at one monitoring site even with the implementation of the I&M program without traffic improvements.

5. In addition to the monitoring sites, 26 additional locations (hot spots) were analyzed for possible violation of NAAQS in 1983 and 1987. The results indicate potential for marginal violation of the CO standard in 1987 at three additional sites even with the benefits of I&M program.

7<

CHAPTER 3

SUMMARY OF MONITORING DATA

CO MONITORING DATA

Carbon monoxide concentrations have been monitored at three locations in Mecklenburg County. The data from these monitoring sites are summarized in Table 3.1 for the period 1978 through 1980.

Data on carbon monoxide measurements for 1978 through 1980 show violation of the 8-hour CO standards at all three locations. The 8-hour standard was violated each year at the three sites except at Federal Reserve in 1979. There were no violations of the 1-hour standard at any site during this period.

Monthly summaries of carbon monoxide concentrations measured at the three sites during the most recent year (1980) are given in Table 3.2. The data indicate that Park-Woodlawn and Central-Sharon Amity had more violations of the 8-hour CO standard. Magnitudes of the violations were higher at the Central-Sharon Amity site. The Federal Reserve site had only one violation of the 8-hour standard in 1980.

Time periods during which high CO concentrations were observed at these three sites in 1980 are given in Appendix A. Most of the high concentrations were observed during winter months; highest concentrations occurred in the month of December. Highest concentrations were observed on December 5, 1980 during the late evening hours. Hourly variations of CO concentrations measured during the first six days of December 1980 are also given in Appendix A. Hourly data are given only for the Central-Sharon Amity site where the measured concentrations were found to be the highest.

METEOROLOGICAL DATA

A review of the data on ambient air quality measurements indicates that the highest 1-hour and 8-hour CO concentrations were observed on December 5 and 6, 1980 at all three sites. Surface weather observations for these two days as taken at Charlotte, North Carolina, are given in Tables 3.3 and 3.4. Mixing heights for December 4 through 6, 1980, as determined by the EPA Region IV meteorologist are given in Table 3.5.

8<

TABLE 3.1

SUMMARY OF MEASURED CO CONCENTRATIONS

Site	Year	Maximum 1-Hour (mg/m^3)	2nd Maximum 1-Hour (mg/m^3)	Maximum 8-Hour (mg/m^3)	2nd Maximum 8-Hour (mg/m^3)
Federal	1978	21.9	21.5	15.9	15.2
Reserve	1979	19.5	15.5	10.1	9.0
	1980	21.3	20.2	12.8	11.2
Park-	1978	28.1	19.6	14.4	14.1
Woodlawn	1979	26.7	22.9	14.6	12.5
	1980	24.1	22.7	12.7	12.0
Central-	1978	36.7	34.2	23.6	21.4
Sharon	1979	24.5	21.7	15.6	14.4
Amity	1980	36.9	30.4	24.6	19.2

The standards are 40 mg/m^3 1-hour and 10 mg/m^3 8-hour not to be exceeded more than once per year.

TABLE 3.2

MONTHLY SUMMARY OF CO CONCENTRATIONS IN 1980

Date	Monitoring Site	Concentration in mg/m^3			
		1-Hour Period		8-Hour Period	
		Max.	2nd Max.	Max.	2nd Max.
Jan. 1980	Federal Reserve	10.9	8.6	4.8	4.6
	Park-Woodlawn	18.3	18.0	11.2	11.0
	Central-Sharon Amity	16.0	14.7	9.3	9.1
Feb. 1980	Federal Reserve	--	--	--	--
	Park-Woodlawn	24.1	17.2	9.4	9.0
	Central-Sharon Amity	20.3	18.6	9.3	9.3
March 1980	Federal Reserve	10.0	6.6	4.6	3.7
	Park-Woodlawn	12.6	11.5	8.7	6.7
	Central-Sharon Amity	14.3	14.0	8.2	8.0
April 1980	Federal Reserve	8.0	6.9	4.7	4.3
	Park-Woodlawn	13.8	13.0	8.9	6.8
	Central-Sharon Amity	12.0	11.2	9.0	7.6
May 1980	Federal Reserve	10.0	9.5	6.6	6.0
	Park-Woodlawn	12.9	12.2	7.3	7.0
	Central-Sharon Amity	12.2	11.9	8.3	8.0
June 1980	Federal Reserve	6.9	6.3	3.8	3.6
	Park-Woodlawn	11.8	10.1	8.5	6.9
	Central-Sharon Amity	10.0	9.7	6.4	4.7
July 1980	Federal Reserve	7.5	7.2	5.7	5.6
	Park-Woodlawn	11.3	11.0	7.3	7.0
	Central-Sharon Amity	12.3	12.0	7.2	7.1
Aug. 1980	Federal Reserve	6.9	6.1	5.0	4.6
	Park-Woodlawn	14.2	11.3	7.9	7.6
	Central-Sharon Amity	10.4	9.2	7.8	7.6
Sept. 1980	Federal Reserve	6.6	6.3	4.3	4.0
	Park-Woodlawn	13.6	13.0	7.5	7.2
	Central-Sharon Amity	11.5	11.0	6.7	6.5
Oct. 1980	Federal Reserve	17.9	11.3	7.0	5.6
	Park-Woodlawn	16.3	15.4	8.4	8.3
	Central-Sharon Amity	19.1	18.6	10.2	10.1
Nov. 1980	Federal Reserve	18.2	16.2	12.8	11.2
	Park-Woodlawn	24.1	22.7	10.8	9.9
	Central-Sharon Amity	24.0	21.4	12.7	11.9

TABLE 3.2--Continued

Date	Monitoring Site	Concentration in mg/m^3			
		1-Hour Period		8-Hour Period	
		Max.	2nd Max.	Max.	2nd Max.
Dec. 1980	Federal Reserve	21.3	20.2	12.3	9.2
	Park-Woodlawn	22.7	19.5	12.7	12.0
	Central-Sharon Amity	36.9	30.4	24.6	19.2

TABLE 3.3

SURFACE WEATHER OBSERVATIONS
FOR CHARLOTTE, NC

Day = December 5, 1980

Hour	Wind Speed (Knots)	Direction	Temp. (°F)	Humidity (%)	Stability
0100	0	0	36	58	6
0200	0	0	35	66	6
0300	0	0	33	73	6
0400	0	0	31	75	6
0500	0	0	31	78	6
0600	4	230	34	65	6
0700	3	300	32	73	5
0800	3	70	31	76	4
0900	3	90	37	60	3
1000	4	190	45	51	2
1100	3	250	50	39	1
1200	4	200	54	34	2
1300	3	260	57	30	2
1400	3	10	59	26	2
1500	4	130	62	24	3
1600	4	130	62	23	3
1700	4	160	60	23	4
1800	4	200	57	27	5
1900	0	0	53	34	6
2000	0	0	49	41	6
2100	0	0	47	47	6
2200	0	0	44	52	6
2300	0	0	42	58	6
2400	0	0	39	65	6

12<

TABLE 3.4

SURFACE WEATHER OBSERVATIONS
FOR CHARLOTTE, NC

Day = December 6, 1980

Hour	Wind Speed (Knots)	Direction	Temp. (°F)	Humidity (%)	Stability
0100	0	0	41	62	6
0200	3	340	38	70	6
0300	3	190	37	79	6
0400	0	0	37	79	6
0500	0	0	35	82	6
0600	4	50	35	82	6
0700	4	280	35	82	5
0800	4	90	34	84	4
0900	3	290	41	75	3
1000	4	50	50	58	2
1100	3	140	57	44	1
1200	0	0	61	33	1
1300	3	330	64	34	1
1400	3	150	66	26	2
500	4	140	68	27	2
1600	5	230	68	23	3
1700	6	210	64	31	4
1800	4	220	61	36	5
1900	3	170	59	36	6
2000	4	180	52	51	6
2100	0	0	53	51	6
2200	0	0	47	61	6
2300	0	0	49	57	6
2400	0	0	48	58	6

TABLE 3.5

MIXING HEIGHTS FOR CHARLOTTE, NC
DECEMBER 4-6, 1980

I.	Based on Greensboro Rawinsonde Data				
	4th - 7 p.m. (00Z - 5th)	5th - 7 a.m. (12Z)	5th - 7 p.m. (00Z - 6th)	6th 12Z	6th (00Z - 7th)
	Based on Adiabatic Intersection - 670 Meters	Minimum Tx + 5°C 60 Meters	Adiabatic Intersection - 610 Meters	Minimum Tx + 5°C 60 Meters	Data not provided Estimate based on maximum Tx and 12Z rawinsonde 975 meters.
	Based on Inversion Base (Best) - 670 Meters		Inversion Base - 850 Meters		
	Based on Temperature (Tx) at 7 p.m. - near Zero		7 p.m. Tx Near Zero		
II.	Based on Athens Rawinsonde Data				
	4th - 7 p.m. (00Z - 5th)	5th - 7 a.m. (12Z)	5th - 7 p.m. (00Z - 6th)	6th 12Z	6th (00Z - 7th)
	Adiabatic Intersection - 50 Meters	Minimum Tx + 5° 60 Meters	Adiabatic Intersection - 185 Meters	Minimum Tx + 5°C 60 Meters	Data not provided Estimated 1,070 meters.
	Inversion Base (Best) - 730 Meters		Inversion Base (Best) - 850 Meters		
	7 p.m. Tx Near Zero		7 p.m. Tx Near Zero		

Peak 8-hour CO concentrations were measured during the hours of 1700, December 5 through 0100, December 6, 1980. A look at the surface weather observations for these time periods indicate that the wind was calm or exhibited low velocities for most of the time.

CHAPTER 4

MODELING PROCEDURE

Air quality models are widely used to relate air pollutant emissions to ambient air quality concentrations. The implied relationship between CO concentration and traffic is actually the relationship between CO concentration and traffic related CO emissions. In the vicinity of roadways, emission intensity depends upon variables such as traffic volume, emission characteristics of the vehicle fleet, and operating characteristics of the roadways and intersections. CO concentrations are also dependent upon the characteristics of the atmosphere into which the pollutants are emitted. Factors such as atmospheric stability, surface roughness, and wind speed and direction are important variables which control the dispersion of CO emissions from mobile sources.

MODEL SELECTION

There are several air quality models available for predicting ambient CO concentrations. Among those readily available are Intersection-Midblock-Model (IMM), Modified ISMAP, CALINE-2, PAL, HIWAY, APRAC-2, etc. Though all of these models have different computational algorithms, they have the same generic basis, i.e. Gaussian, which is considered to be the state-of-the-art technique for estimating impacts of nonreactive pollutants such as carbon monoxide, sulfur dioxide, suspended particulates, etc.

Among these models, only APRAC-2 (Reference 1) and IMM (Reference 2) have built-in traffic models to compute queue lengths and delay times for an intersection. APRAC-2 calculates emission factors according to Supplement 5 of AP-42, which is not the most current methodology available from EPA. IMM includes a more current methodology (MOBILE-1) (Reference 3) to calculate automobile emission factors.

After review of the dispersion models available, it was decided that IMM is the most appropriate for the detailed assessment of CO concentrations in Mecklenburg County. Salient features of the IMM model are described in Appendix B. Several revisions to the IMM model have been made and the latest one available from EPA is IMM-5.

Recently EPA updated automobile emission factors in a computer program called MOBILE-2 (Reference 4). ES revised the IMM-5 model to include MOBILE-2 emission factors. The revised version of the IMM-5 model will be

referred to as IMM-6 in this report. Thus, IMM-6 represents the state-of-the-art for analysis of CO concentrations in the vicinity of roadways. It is a combination of state-of-the-art for emission calculations using the MODAL model (Reference 5) and MOBILE-2, dispersion modeling using HIWAY (Reference 6) and the determination of signal cycle times, delays, and queue lengths through application of traffic engineering principles.

TRAFFIC DATA

Detailed traffic data specific to particular locations being analyzed were provided by the City of Charlotte's Department of Transportation. These included the following:

- Traffic volume
- Vehicle speed
- Traffic signal operation
- Vehicle mode operation
- Roadway configuration including road alignments, number of lanes, lane width, etc.

A review of the air quality measurements had indicated that there were no violations of the 1-hour CO standard but the 8-hour standard was violated on several occasions. Therefore, it was decided that the analysis be performed for the peak 8-hour period. Consequently, the traffic data used in the analysis refer to the average traffic during the peak 8-hour period.

METEOROLOGICAL CONSIDERATIONS

The important climatological elements governing the dispersion and and dilution of air pollutants are wind speed and atmospheric stability. Wind speed determines the rate at which the pollutants are diluted; a strong wind results in a high rate of ventilation and consequently rapid dilution. The stability of the atmosphere determines the rate at which the pollutants are dispersed; large vertical and horizontal wind fluctuations result in a rapid dispersion. The concentration of pollutants at any receptor depends also upon the steadiness and persistence of the wind direction which affects that receptor. These factors, properly combined, are used to estimate the pollutant concentration by use of appropriate dispersion models.

The wind parameters are routinely observed and recorded at National Weather Service First Order Stations and at many military airports. For this study the surface weather data as observed at the Charlotte Airport were obtained. Hourly meteorological data for December 5 and 6, 1980, are shown in Tables 3.3 and 3.4. December 5 and 6 are the days when high CO concentrations were observed at all three monitoring sites.

A look at the monitoring data (see Appendix A) indicates that the peak 8-hour CO levels were observed between 5 p.m. on December 5 and 1 a.m. on December 6 at Park-Woodlawn and Central-Sharon Amity sites. The peak 8-hour value at Federal Reserve was observed from 9 p.m. on December 5 to 5 a.m. on December 6. A review of the meteorological data (see

Tables 3.3 and 3.4) for these hours indicate that the winds were mostly calm and exhibited low speeds (1.5 to 2.0 m/sec) for a few hours from a southerly direction.

Since the National Ambient Air Quality Standards (NAAQS) for carbon monoxide are 9 ppm, 1-hour and 35 ppm, 8-hour maximums not to be exceeded more than once per year, it is desirable to model for the worst case. Because of the localized nature of the CO problem, the worst condition is defined as the combination of high emission rates and adverse meteorological conditions that results in the maximum ground level concentration. High emission rates are associated with high traffic volumes occurring under congested traffic conditions. Meteorological conditions pertaining to maximum concentrations from ground level sources such as automobiles will be light winds and stable atmospheric conditions. This is also demonstrated by the meteorological data given in Tables 3.3 and 3.4 for the days when high CO concentrations were measured at the monitoring sites in Mecklenburg County.

Though the winds during which peak 8-hour CO levels were observed are mostly calm, none of the available models are able to handle calm conditions. For modeling purposes, a wind speed of 2.0 m/sec and stability class of 6 (very stable) were assumed. Wind directions parallel to the highways usually result in the highest concentrations in case of highways of unlimited lengths. In case of receptors near intersections, maximum concentrations are expected for wind directions from queue lengths towards the receptor, since maximum CO emissions occur from idling and accelerating-decelerating vehicles. Hence, the wind angle was selected depending upon the type of the intersection and the source lengths so as to maximize the predicted concentrations.

There are several other reasons for making these assumptions for the worst meteorological conditions: (1) Wind data are usually available from National Weather Service Stations at an airport which can be quite distant from the source and the receptor. Microscale circulations near the site can result in a different wind regime than that observed at the airport. This is especially true in the case of CO hot spots which are caused by ground level sources (automobiles) and are located mostly in urban areas surrounded by buildings. (2) Wind speed measuring instruments at most of the airports are not sensitive to low wind speeds. The most commonly used wind speed measurement system is the cup anemometer revolving about a vertical shaft. Friction in these instruments is enough to cause the starting speed to lie in the range of 1 to 2 m/sec (2 to 4 knots). Thus, wind speeds lower than 2 knots could not be accurately measured. (3) Studies (Reference 7) undertaken to determine the heat island effects of cities indicate that at night the average city wind speeds tend to be greater than those of the countryside. Thus, for the nighttime hours when calm conditions were reported at the airport, there could be light winds over the city's build-up areas.

MODELING FOR PEAK 8-HOUR CONCENTRATION

An ideal situation to estimate the 8-hour average concentration would be to model for the 8 consecutive hours during which the maximum concentration was measured. However, in this case 6 hours out of 8-hour peak period

were calm and the model is not capable of handling calm conditions. Hence, the model was run using average hourly traffic for the peak 8-hour period. The wind was assumed to be constant for the period. Since an estimate of the 8-hour maximum concentration is desired, the use of constant wind speed and direction over an 8-hour period is a realistic approach.

BACKGROUND CONCENTRATION

Carbon monoxide concentrations occurring in the immediate vicinity of a street or highway are generally considered to be comprised of two components: (1) a concentration directly attributable to the nearby roadways, and (2) a background component that is attributable to other emission sources including more distant roadways. The background concentration is added to the locally generated CO concentration to determine the total concentration at a given receptor. Background concentration is considered to be uniform throughout the area. Generally, the locally generated CO concentration is substantially greater than the background component.

Several methods have been suggested to determine background concentrations. The preferred approach involves long-term monitoring and/or modeling. Such detailed analysis for background concentration was beyond the scope of this study. EPA's Guideline for Review of Indirect Sources (Reference 8) suggested a value of 3.0 to 5.9 mg/m^3 for background concentration for the year 1974. An estimate of the background concentration in a large metropolitan area presented in the Hot Spot Guideline is 1.7 to 2.9 mg/m^3, normalized to 1982 conditions. Normalizing (Reference 9) this concentration to 1987 emission conditions results in a background concentration of 1.0 to 1.7 mg/m^3. For the purposes of this study, the following background concentration for the peak 8-hour period were used:

Year	Background Conc. (8-hour Range)
1980	3.0 mg/m^3
1983	2.0 mg/m^3
1987	1.5 mg/m^3

MODEL VALIDATION

In order to provide greater confidence in model predictions, these predictions should be validated by comparing them with observed concentrations. Comparison of observed and predicted concentrations has been attempted using a number of statistical techniques. Normally, simple linear regression analysis is used to quantify such a comparison for annual average concentrations. Since air quality data from only three monitoring sites are available for comparison with model predictions, a regression analysis is not appropriate. Furthermore, such an analysis for short-term concentrations has rarely demonstrated good correspondence between model predictions and observed concentrations.

National Ambient Air Quality Standards for carbon monoxide are 35 ppm, 1-hour and 9 ppm, 8-hour maximums not to be exceeded more than once per

year and a review of the ambient air quality monitoring data indicates that the 8-hour standard is more likely to be violated.

For the purpose of comparison, maximum 8-hour concentrations were modeled for 1980 traffic conditions and compared with the maximum observed 8-hour concentrations in 1980. Traffic data for the monitoring sites are given in Appendix C and sample computer printouts are given in Appendix D. The meteorological data as discussed earlier in this chapter were used. The comparison is shown in Table 4.1. Model predictions were slightly higher than the observed concentrations at two of the sites whereas the model underpredicted maximum 8-hour concentration at the other (Federal Reserve).

Major traffic parameters affecting the predicted concentrations for the three monitoring sites are shown in Table 4.2. Receptor distance from the nearest lane appears to have the predominant effect on predicted concentrations. This receptor distance for Central-Sharon Amity is 15 feet compared to 27 feet for the other two sites. This accounts for the low measured and modeled concentrations at the Federal Reserve and Park-Woodlawn compared to the high measured and modeled prediction at the Central-Sharon Amity site. Average traffic volume on the street nearest to the receptor is lower for Federal Reserve than that for the other two sites. Volume/capacity ratio is highest for Park-Woodlawn and lowest for Federal Reserve.

TABLE 4.1

COMPARISON OF PREDICTED VS. MEASURED CONCENTRATION

Monitoring Site	Maximum 8-Hour CO Concentration in mg/m^3	
	Measured[a]	Modeled[b]
Federal Reserve	12.3	7.4[c]
Park-Woodlawn	12.7	16.3
Central-Sharon Amity	24.6	27.7

a Maximum 8-hour measured in 1980.

b Maximum 8-hour predicted using 1980 traffic data and assumed worst-case meteorological conditions and include a background value of 3.0 mg/m^3 for the 8-hour period.

c Traffic data provided for Park-Woodlawn and Central-Sharon Amity were average hourly traffic volumes for the peak 8-hour traffic period. The traffic volumes for the peak 8-hour traffic period for Federal Reserve consisted of three different time periods, namely, 1000 to 1600 hours, 1600 and 1700 hours, and 1700 to 1800 hour. These were modeled individually and weighted average concentration was computed. Same worst meteorological conditions were used for all three time periods.

TABLE 4.2

TRAFFIC PARAMETERS FOR THREE MONITORING SITES

Parameter	Monitoring Site		
	Federal Reserve	Park-Woodlawn	Central-Sharon Amity
Nearest street	South Tryon	West Woodlawn	North-Sharon Amity
Average traffic volume on the nearest street (Veh/hour)	560 (1000-1600) 630 (1600-1700) 470 (1700-1800)	900 (1030-1830)	670 (1100-1900)
Capacity for the nearest street	3000 (1000-1600) 3000 (1600-1700) 4000 (1700-1800)	2900 (1030-1830)	2800 (1100-1900)
Volume/Capacity ratio	0.186 (1000-1600) 0.210 (1600-1700) 0.118 (1700-1800)	0.310 (1030-1830)	0.239 (1100-1900)
Receptor distance from nearest street	27 feet	27 feet	15 feet
Receptor distance from intersection	65 feet	114 feet	190 feet

CHAPTER 5

PROJECTED AIR QUALITY

The main purpose of this study was to determine the 1982 and 1987 CO attainment status in Mecklenburg County. For those areas not attaining the CO standards, an I&M program is to be implemented by 1982. To determine the air quality improvements due to the implementation of an I&M program, CO air quality was predicted for the years 1983 (one year after implementation) and 1987 (5 years after implementation). Prediction of CO air quality for the year 1987, without the implementation of the I&M program, was also made. The results are shown in Table 5.1.

As discussed in Chapter 3, the review of the monitoring data indicated no violation of the 1-hour CO standards. Hence, the analysis was restricted to the prediction of 8-hour CO concentrations. The results shown in Table 5.1 indicate that site number 3 (Central-Sharon Amity) will continue to have the potential for violating the 8-hour CO standard even with the implementation of the I&M program.

Model predicted a reduction of 43 to 50% from 1980 to 1987 in CO concentration at the Federal Reserve monitoring site. Though the model underpredicted CO concentration for this site, application of similar reduction to the 1980 measured concentration would indicate that this site would not be in violation of the CO standards in 1987. Model predictions for 1980 for the other two monitoring sites were in good agreement with 1980 measured concentrations. Thus, the 1987 predicted concentrations at these sites are reasonable estimates for the future air quality levels at these locations.

In addition to the analysis for three monitoring sites, air quality analyses were performed for other potential CO hot spots in the area. The results of these analyses are given in Appendix E. The analysis indicated that three additional sites will not attain the CO standards by 1987 even with the benefits of the I&M program. Due to unavailability of data, the effects of growth in traffic volumes and external-based vehicles (not subject to I&M) were not considered. However, the results indicate that approximately 20% growth from 1980 to 1987 in traffic could be accommodated before causing possible violation of CO standards at more than four sites as predicted in this analysis.

TABLE 5.1

PREDICTED AIR QUALITY

Site Number and Description	8-Hour CO Concentration[a] (mg/m^3) 1983 with I&M	1987 without I&M	1987 with I&M
1. Federal Reserve	5.4	4.4	3.9
2. Park-Woodlawn	11.7	9.4	8.1
3. Central-Sharon Amity	20.3	16.3	13.9

[a] Includes the background concentrations given in Chapter 4.

REFERENCES

1. Ludwig, F. L. and R. L. Mancuso, "User's Manual for the APRAC-2 Emissions and Diffusion Model", prepared by Stanford Research Institute, Menlo Park, California for U.S. EPA Region IX, 1977.

2. Carbon Monoxide Hot Spot Guidelines, Volume V: User's Manual for Intersection-Midblock-Model, EPA-450/3-78-037, August 1978.

3. User's Guide to MOBILE-1 (Mobile Source Emission Model), U.S. EPA, EPA-400/9-78-007, August 1978.

4. User's Guide to MOBILE-2 (Mobile Source Emission Model), U.S. EPA, EPA-400/9-78-005, 1981.

5. Automobile Exhaust Emissions MODAL Analysis Model, U.S. EPA, EPA-460/3-74-005, January 1974.

6. User's Guide for HIWAY, a Highway Air Pollution Model, U.S. EPA, EPA-650/4-74-008, February 1975.

7. Studies of T. J. Chandler, 1965: The Climate of London, as reported in EPA Publication, "The Climate of the Cities", Office of Air Program Publications, No. AP-49, 3rd Printing, February 1972.

8. Guideline for Air Quality Maintenance Planning and Analysis, Volume 9: Evaluating Indirect Sources, U.S. EPA, EPA-450/4-75-001.

9. An Assessment of the Potential for Violation of the CO Standards in Northern Virginia in 1982 and 1987, Engineering-Science report submitted to Virginia State Air Pollution Control Board, May 1980.

APPENDIX A

DAYS WITH HIGHEST OBSERVED CO CONCENTRATIONS

Federal Reserve:

January 1980

1 hr. Max:	10.9 mgCO/m^3	0700-0800	1-3-80
1 hr. 2nd Max:	8.6 mgCO/m^3	1700-1800	1-7-80
8 hr. Max:	4.8 mgCO/m^3	1100-1900	1-7-80
8 hr. 2nd Max:	4.6 mgCO/m^3	0600-1400	1-3-80

February 1980

Monitor down entire month.

March 1980

1 hr. Max:	10.0 mgCO/m^3	1700-1800	3-20-80
1 hr. 2nd Max:	6.6 mgCO/m^3	1700-1800	3-12-80
8 hr. Max:	4.6 mgCO/m^3	1100-1800	3-20-80
8 hr. 2nd Max:	3.7 mgCO/m^3	1000-1800	3-28-80

April 1980

1 hr. Max:	8.0 mgCO/m^3	0800-0900	4-3-80
1 hr. 2nd Max:	6.9 mgCO/m^3	0700-0800	4-24-80
8 hr. Max:	4.7 mgCO/m^3	0700-1500	4-3-80
8 hr. 2nd Max:	4.3 mgCO/m^3	1000-1800	4-11-80

May 1980

1 hr. Max:	10.0 mgCO/m^3	2200-2300	5-3-80
1 hr. 2nd Max:	9.5 mgCO/m^3	0100-0200	5-3-80
8 hr. Max:	6.6 mgCO/m^3	2000-0400	5-3-80
8 hr. 2nd Max:	6.0 mgCO/m^3	2000-0400	5-21-22-80

June 1980

1 hr. Max:	6.9 mgCO/m^3	1600-1700	6-24-80
1 hr. 2nd Max:	6.3 mgCO/m^3	1500-1600	6-3-80
8 hr. Max:	3.8 mgCO/m^3	0900-1700	6-16-80
8 hr. 2nd Max:	3.6 mgCO/m^3	0900-1200	6-3-80

July 1980

1 hr. Max:	7.5 mgCO/m^3	2300-2400-0100	7-11-12-80
1 hr. 2nd Max:	7.2 mgCO/m^3	0600-0700	7-2-80
8 hr. Max:	5.7 mgCO/m^3	0600-1400	7-15-80
8 hr. 2nd Max:	5.6 mgCO/m^3	2000-0400	7-11-12-80

August 1980

1 hr. Max:	6.9 mgCO/m^3	1500-1600-1700	8-15-80
1 hr. Max:	6.9 mgCO/m^3	0700-0800	8-6-80
1 hr. 2nd Max:	6.1 mgCO/m^3	0600-0700	8-7-80
8 hr. Max:	5.0 mgCO/m^3	0900-1700	8-15-80
8 hr. 2nd Max:	4.6 mgCO/m^3	1000-1800	8-15-80

September 1980			
1 hr. Max:	6.6 mgCO/m^3	1500-1600	9-12-80
1 hr. 2nd Max:	6.3 mgCO/m^3	0800-0900	9-19-80
8 hr. Max:	4.3 mgCO/m^3	0600-1300	9-19-80
8 hr. 2nd Max:	4.0 mgCO/m^3	0800-1500	9-12-80
October 1980			
1 hr. Max:	17.9 mgCO/m^3	0600-0700	10-16-80
1 hr. 2nd Max:	11.3 mgCO/m^3	0700-0800	10-16-80
8 hr. Max:	7.0 mgCO/m^3	0400-1100	10-10-80
8 hr. 2nd Max:	5.6 mgCO/m^3	0200-1000	10-16-80
November 1980			
1 hr. Max:	18.2 mgCO/m^3	0700-0800	11-13-80
1 hr. 2nd Max:	16.2 mgCO/m^3	2300-2400	11-12-80
8 hr. Max:	12.8 mgCO/m^3	2100-0500	11-12-13-80
8 hr. 2nd Max:	11.2 mgCO/m^3	1800-0200	11-19-20-80
December 1980			
1 hr. Max:	21.3 mgCO/m^3	2200-2300	12-5-80
1 hr. 2nd Max:	20.2 mgCO/m^3	2300-2400	12-5-80
8 hr. Max:	12.3 mgCO/m^3	2100-0500	12-5-6-80
8 hr. 2nd Max:	9.2 mgCO/m^3	0600-1400	12-6-80

Park Road:

January 1980

1 hr. Max:	18.3 mgCO/m^3	0800-0900	1-2-80
1 hr. 2nd Max:	18.0 mgCO/m^3	0800-0900	1-3-80
8 hr. Max:	11.2 mgCO/m^3	1700-0100	1-15-19-80
8 hr. 2nd Max:	11.0 mgCO/m^3	0900-1700	1-18-80

February 1980

1 hr. Max:	24.1 mgCO/m^3	0800-0900	2-14-80
1 hr. 2nd Max:	17.2 mgCO/m^3	0800-0900	2-15-80
8 hr. Max:	9.4 mgCO/m^3	0200-1000	2-14-80
8 hr. 2nd Max:	9.0 mgCO/m^3	0600-1400	2-19-80

March 1980

1 hr. Max:	12.6 mgCO/m^3	0700-0800	3-19-80
1 hr. 2nd Max:	11.5 mgCO/m^3	1700-1800	3-25-80
8 hr. Max:	8.7 mgCO/m^3	1300-2100	3-28-80
8 hr. 2nd Max:	6.7 mgCO/m^3	1300-2000	3-20-80
		1200-2000	3-25-80

April 1980

1 hr. Max:	13.8 mgCO/m^3	0700-0800	4-3-80
1 hr. 2nd Max:	13.0 mgCO/m^3	1700-1800	4-21-80
8 hr. Max:	8.9 mgCO/m^3	0600-1400	4-3-80
8 hr. 2nd Max:	6.8 mgCO/m^3	1500-2300	4-21-80

May 1980

1 hr. Max:	12.9 mgCO/m^3	0700-0800	5-27-80
1 hr. 2nd Max:	12.2 mgCO/m^3	0600-0700	5-5-80
8 hr. Max:	7.3 mgCO/m^3	1000-1800	5-9-80
8 hr. 2nd Max:	7.0 mgCO/m^3	1200-2000	5-8-80

June 1980

1 hr. Max:	11.8 mgCO/m^3	1600-1700	6-26-80
1 hr. 2nd Max:	10.1 mgCO/m^3	1500-1000	6-26-80
8 hr. Max:	8.5 mgCO/m^3	1000-1800	6-26-80
8 hr. 2nd Max:	6.9 mgCO/m^3	1000-1800	6-25-80

July 1980

1 hr. Max:	11.3 mgCO/m^3	0700-0800	7-24-80
1 hr. 2nd Max:	11.0 mgCO/m^3	0600-0700	7-29-80
8 hr. Max:	7.3 mgCO/m^3	0600-1400	7-24-80
8 hr. 2nd Max:	7.0 mgCO/m^3	0700-1500	7-24-80

August 1980

1 hr. Max:	14.2 mgCO/m^3	1600-1700	8-19-80
1 hr. 2nd Max:	11.3 mgCO/m^3	1600-1700	8-26-80
8 hr. Max:	7.9 mgCO/m^3	1200-2000	8-26-80
8 hr. 2nd Max:	7.6 mgCO/m^3	1100-1900	8-26-80

September 1980

1 hr. Max:	13.6 mgCO/m^3	0800-0900	9-5-80
1 hr. 2nd Max:	13.0 mgCO/m^3	0700-0800	9-5-80
8 hr. Max:	7.5 mgCO/m^3	0600-1400	9-30-80
8 hr. 2nd Max:	7.2 mgCO/m^3	0700-1500	9-30-80
		0900-1700	9-19-80

October 1980

1 hr. Max:	16.3 mgCO/m^3	0700-0800	10-9-80
1 hr. 2nd Max:	15.4 mgCO/m^3	0700-0800	10-14-80
8 hr. Max:	8.4 mgCO/m^3	0600-1400	10-22-80
8 hr. 2nd Max:	8.3 mgCO/m^3	0500-1300	10-22-80

November 1980

1 hr. Max:	24.1 mgCO/m^3	0800-0900	11-14-80
1 hr. 2nd Max:	22.7 mgCO/m^3	0700-0800	11-20-80
8 hr. Max:	10.8 mgCO/m^3	0100-0900	11-20-80
8 hr. 2nd Max:	9.9 mgCO/m^3	1800-0200	11-14-15-80

December 1980

1 hr. Max:	22.7 mgCO/m^3	0800-0900	12-15-80
1 hr. 2nd Max:	19.5 mgCO/m^3	0700-0800	12-15-80
8 hr. Max:	12.7 mgCO/m^3	1700-0100	12-5-6-80
8 hr. 2nd Max:	12.0 mgCO/m^3	0100-0900	12-6-80

Central:

January 1980

1 hr. Max:	16.0 mgCO/m^3	1900-2000	1-15-80
1 hr. 2nd Max:	14.7 mgCO/m^3	0700-0800	1-2-80
8 hr. Max:	9.3 mgCO/m^3	1800-0200	1-15-16-80
8 hr. 2nd Max:	9.1 mgCO/m^3	1800-0200	1-19-20-80

February 1980

1 hr. Max:	20.3 mgCO/m^3	0700-0800	2-11-80
1 hr. 2nd Max:	18.6 mgCO/m^3	0700-0800	2-21-80
8 hr. Max:	9.5 mgCO/m^3	1700-0100	2-14-15-80
8 hr. 2nd Max:	9.3 mgCO/m^3	1800-0200	2-14-15-80

March 1980

1 hr. Max:	14.3 mgCO/m^3	2000-2100	3-15-80
1 hr. 2nd Max:	14.0 mgCO/m^3	1900-2000	3-15-80
8 hr. Max:	8.2 mgCO/m^3	1600-2400	3-15-80
8 hr. 2nd Max:	8.0 mgCO/m^3	1500-2300	3-15-80

April 1980

1 hr. Max:	12.0 mgCO/m^3	1800-1900-2000	4-18-80
1 hr. 2nd Max:	11.2 mgCO/m^3	1900-2000	4-10-80
8 hr. Max:	9.0 mgCO/m^3	1400-2200	4-18-80
8 hr. 2nd Max:	7.60 mgCO/m^3	1400-2200	4-3-80

May 1980

1 hr. Max:	12.2 mgCO/m^3	2000-2100	5-30-80
1 hr. 2nd Max:	11.9 mgCO/m^3	1900-2000	5-30-80
8 hr. Max:	8.3 mgCO/m^3	1400-2200	5-30-80
8 hr. 2nd Max:	8.0 mgCO/m^3	1300-2100	5-23-80

June 1980

1 hr. Max:	10.0 mgCO/m^3	2000-2100	6-19-80
1 hr. 2nd Max:	9.7 mgCO/m^3	0600-0700	6-23-80
8 hr. Max:	6.4 mgCO/m^3	1400-2200	6-19-80
8 hr. 2nd Max:	4.7 mgCO/m^3	0600-1400	6-23-80

July 1980

1 hr. Max:	12.3 mgCO/m^3	2000-2100	7-18-80
1 hr. 2nd Max:	12.0 mgCO/m^3	0600-0700	7-31-80
8 hr. Max:	7.2 mgCO/m^3	1500-2300	7-18-80
8 hr. 2nd Max:	7.1 mgCO/m^3	1600-2400	7-18-80

August 1980

1 hr. Max:	10.4 mgCO/m^3	1900-2000	8-29-80
1 hr. 2nd Max:	9.2 mgCO/m^3	1600-1700	8-29-80
		1600-1700-1800	8-30-80
		1700-1800	8-20-80
		0600-0700	8-27-80
8 hr. Max:	7.8 mgCO/m^3	1300-2100	8-29-80
8 hr. 2nd Max:	7.6 mgCO/m^3	1200-2000	8-29-80

September 1980

1 hr. Max:	11.5 mgCO/m^3	1800-1900	9-20-80
1 hr. 2nd Max:	11.0 mgCO/m^3	0600-0700	9-5-80
8 hr. Max:	6.7 mgCO/m^3	1200-2000	9-19-80
8 hr. 2nd Max:	6.5 mgCO/m^3	1300-2100	9-20-80

October 1980

1 hr. Max:	19.1 mgCO/m^3	0600-0700	10-16-80
1 hr. 2nd Max:	18.6 mgCO/m^3	0600-0700	10-2-80
8 hr. Max:	10.2 mgCO/m^3	1400-2200	10-10-80
8 hr. 2nd Max:	10.1 mgCO/m^3	1300-2100	10-17-80

November 1980

1 hr. Max:	24.0 mgCO/m^3	0700-0800	11-10-80
1 hr. 2nd Max:	21.4 mgCO/m^3	0200-0800	11-13-80
8 hr. Max:	12.7 mgCO/m^3	1800-0200	11-19-20-80
8 hr. 2nd Max:	11.9 mgCO/m^3	1700-0100	11-14-15-80

December 19:0

1 hr. Max:	36.9 mgCO/m^3	1900-2000	12-6-80
1 hr. 2nd Max:	30.4 mgCO/m^3	2000-2100	12-5-80
8 hr. Max:	24.6 mgCO/m^3	1700-0100	12-5-6-80
8 hr. 2nd Max:	19.2 mgCO/m^3	1700-0100	12-6-7-80

ta Edit ☐

By _____

Division of Environmental Management
Air Quality Section
Air Monitoring Data Sheet (Hourly)

Emergency Episode ☐

Special Study ☐

Control

1	County No. 60	Area Code 0700	Site No. 32	Inspector No.	Signature								
2	Time Interval: 1 Hr [X] 2 Hr [ ] 4 Hr [ ] 6 Hr [ ] 8 Hr [ ] 12 Hr [ ]				Pollution Code: COH [ ] CO [X] O3 [ ] HC [ ]								
3	Year 80	SAMPLE READINGS	1	2	3	4	5	6	7	8	9	10	11	12
		Start Hr.	00	01	02	03	04	05	06	07	08	09	10	11
4	Month 12	A.M. Data	0.6	0.6	0.6	0.6	0.9	0.9	3.4	5.1	4.6	1.7	1.4	1.7
5	Day 01	P.M. Data	3.4	2.3	2.6	3.1	5.4	16.0	9.1	6.0	5.7	9.7	9.1	4.3
		Start Hr.	12	13	14	15	16	17	18	19	20	21	22	23
		Start Hr.	00	01	02	03	04	05	06	07	08	09	10	11
6	Month 12	A.M. Data	2.9	0.9	0.6	0.9	0.6	1.4	2.0	4.3	3.7	2.6	1.4	1.1
7	Day 02	P.M. Data	1.4	0.9	2.0	2.0	2.6	3.1	2.3	1.4	1.4	0.6	0.6	0.9
		Start Hr.	12	13	14	15	16	17	18	19	20	21	22	23
		Start Hr.	00	01	02	03	04	05	06	07	08	09	10	11
8	Month 12	A.M. Data	0.6	0.6	0.6	0.6	0.6	0.9	2.9	7.1	2.3	0.9	0.6	Cal
9	Day 03	P.M. Data	0.6	0.6	0.9	0.6	2.3	5.4	6.0	6.3	9.1	4.9	2.3	3.1
		Start Hr.	12	13	14	15	16	17	18	19	20	21	22	23
		Start Hr.	00	01	02	03	04	05	06	07	08	09	10	11
10	Month 12	A.M. Data	1.1	1.7	1.1	0.9	1.1	1.7	4.6	10.6	11.7	Cal	—	Cal
11	Day 04	P.M. Data	Cal	—	—	Cal	9.7	11.2	14.9	16.9	14.0	12.9	13.7	11.7
		Start Hr.	12	13	14	15	16	17	18	19	20	21	22	23
		Start Hr.	00	01	02	03	04	05	06	07	08	09	10	11
12	Month 12	A.M. Data	8.3	6.0	3.4	3.4	3.7	0.9	2.9	7.7	5.4	5.7	2.9	4.3
13	Day 05	P.M. Data	Cal	5.7	6.0	10.6	14.0	20.9	22.3	27.2	30.4	24.1	24.6	22.9
		Start Hr.	12	13	14	15	16	17	18	19	20	21	22	23
		Start Hr.	00	01	02	03	04	05	06	07	08	09	10	11
14	Month 12	A.M. Data	24.3	10.6	8.9	8.9	6.9	7.2	9.7	10.6	9.7	4.9	5.2	6.3
15	Day 06	P.M. Data	6.9	6.3	8.9	8.6	5.4	9.2	26.9	36.9	28.6	19.2	9.7	15.8
		Start Hr.	12	13	14	15	16	17	18	19	20	21	22	23
16	Remarks													
17	Final Analysis	Date Ckd Mo.	Day	Yr.	Analyst No.	Signature	Reviewed By					Date Mo.	Day	Yr.

FRIDAY

SATURDAY

AQ-42 Rev. 10-1-72

APPENDIX B

DETAILS OF IMM-6 MODEL

IMM-6

IMM-6 is a modified version of Intersection-Midblock-Model (IMM) designed to estimate the impact of automobile traffic upon carbon monoxide concentration at selected receptor locations. IMM as available from the U.S. Environmental Protection Agency (EPA) includes MOBILE-1 emission factors for highway vehicles and was labeled as IMM-5. IMM-5 includes several revisions since its initial inception. Recently an update of MOBILE-1 was released and is called MOBILE-2. Hence, IMM was modified to include MOBILE-2 emission factors. Thus, IMM-6 presents the state-of-the-art of automobile emission calculations, dispersion model, and determination of signal cycle times, delays, and queue lengths through application of traffic engineering principles.

The model is able to handle receptors located near intersections, at midblock locations and along street canyons. The first part of IMM is devoted to the calculation of average queue lengths and delay times based upon input signalization characteristics, lane volumes, and lane capacities. The queue length and delay times together with input cruise speeds, accelerations, and decelerations are used by the MODAL model for calculation of cruise and excess emissions. These emissions are then corrected for vehicle population characteristics and assigned to traffic links as line source emission rates, which along with receptor locations and meteorological data, are input to a dispersion model for calculation of hourly carbon monoxide concentrations.

The intersection serves as the primary focus for model input and intermediate calculations. As the model now stands, it has the capability of handling a network of up to two intersections. Each intersection is currently restricted to having two signal phases. For each of the two phases per intersection currently allowed in the program, there are two intersection approaches.

Each combination of intersection, phase, and approach uniquely defines a link approaching an intersection. A link is directional; consequently, a two-way street consists of two links. Input parameters for each of these links include traffic volume (vehicle /hour) for the link as a whole, west to east and south to north coordinates (km) of the endpoints of the link center lines, effective emission height (m) for the link, width of the link (m), number of lanes for the link (one, two, or four), cruise speed on the link (mi/hr), deceleration into the queue (mi/hr/sec) (must be input as a negative acceleration), and acceleration out of the queue (mi/hr/sec). The link centerline endpoints need not be numbered in any particular order since the coordinates of the approximate center of the intersection (a set of variables input earlier) serve to fix the orientation of the link. An option is provided for consideration

of the link as a cut section of a specified width (m). The fractional portion of the link emissions assigned to each lane is also input to the program, and used to input into the dispersion submodel; however, the volume of traffic per link used in the calculation of cycle time, green time, delay, and queue length is calculated within the program simply by dividing the total link volume by the number of lanes. For specifying the fractional emissions for each lane within a link, the order of the lanes is from left to right when looking along the link from the first specified endpoint to the second. Finally, an hourly adjustment of the volume on all links is also input to the program.

Parameters for those links not approaching an intersection are input after all the data pertaining to the links that do approach an intersection are read into the program. The same parameters are input for these links except for the accelerations into and out of the queue. Also, only a single vehicle speed is specified. For these links the queue lengths and delay times are set equal to zero by the program. In setting up the coordinates for these two different types of links, the links approaching an intersection should terminate at the intersection stop line while the link not approaching the intersection (leaving the intersection) should originate at the terminus of the first link to ensure that the emissions from the actual intersection are realistic.

EMISSIONS CALCULATIONS

After the link parameters have been input, the emissions for the three different modes (cruise, idle, and acceleration-deceleration) are calculated. The cruise and acceleration-deceleration emissions are calculated by use of the EPA MODAL Analysis Model,[1] parts of which have been incorporated as subroutines in the IMM. Idle emissions are calculated by use of the MOBILE-2 program.[2]

Traffic Calculations

Once the cruise, idling, and acceleration-deceleration emissions rates have been determined, the traffic calculations are carried out. If the "free flow" program option has been specified by the user, no traffic calculations are performed and cruise emissions are assumed everywhere. If the signal for a particular intersection is fixed time, then the green time and the cycle time are specified by the user. For a demand actuated signal, these are computed internally by the IMM-6 program.

EMISSION CORRECTION

Since the emissions obtained from the MODAL Analysis Model correspond to 1977 emission rates for light-duty vehicles, corrections must be made to account for the actual calendar year emission rates and the effects of vehicle mix, temperature, altitude, percent cold-start operation, and percent hotstart operation.

The MOBILE-2 program is used to calculate correction factors to accomplish this correction. The MOBILE-2 program allows the correction of idle

cruise, deceleration, and acceleration emissions calculated according to the following equations:

E_I^S = modified MOBILE-2 composite idle emission factor for specified Scenario S (i.e., specified year cold starts and hot starts, temperature, vehicle mix, etc.)

$$E_C^S = E_C \frac{E_{FTP}^S}{E_{FTP}^{base}}$$

$$E_D^S = E_D \frac{E_{FTP}^S}{E_{FTP}^{base}}$$

$$E_A^S = E_A \frac{E_{FTP}^S}{E_{FTP}^{base}}$$

where E_{FTP}^{base} = the MOBILE-2 composite emission estimate at the average speed for which E_C, E_A, or E_D were calculated and a stabilized 100 percent LDV vehicle mix for 1977 low altitude.

E_{FTP}^S = the MOBILE-2 composite emission estimate for the specified scenario.

These equations multiply the MODAL Model emission estimate by the ratio of two MOBILE-2 emission estimates, one for the scenario of interest and one at the same conditions as the MODAL Model.

Dispersion Calculations

The lane-by-lane emissions for each link are used by the EPA HIWAY Model[3] or the Street Canyon Model[4] for the calculation of hourly carbon monoxide concentrations at selected receptor locations.

Since the EPA HIWAY Model has been described in detail elsewhere, we will present here only a brief discussion of its operational characteristics. The contribution of each small element of roadway to the concentration at a receptor location is calculated as a function of wind direction, wind speed, and stability by use of the Gaussian plume formula. The contribution of the entire length of the roadway is obtained by line integration of the expression. Since the HIWAY Model was designed originally to accept emissions input for an entire street (both directions of travel), it will accept only the following numbers of lanes: 1, 2, 4, etc. It also requires the input of a median strip width. Since we desired to input data to HIWAY (now a subroutine of the IMM) on a link-by-link basis, the median width was set equal to zero, but the lane number restriction still remained so that three lanes per link could not be used. One way to circumvent this problem is to assume a fourth lane with zero volume and increase the link volume so that the link volume divided by the new number of lanes gives the same volume per

lane. This will ensure that the queue lengths and delays will be calculated properly. Then the fraction of link emissions assigned to each lane must be multiplied by the ratio of the number of old lanes to the number of new lanes with the fraction assigned to the new lane equal to zero. This second step will ensure that the emissions per lane will not be affected. In any case, the user must remember to locate the link centerline at the physical centerline of the link. The HIWAY Model will assume that all lanes have the same width and that the width of each lane is equal to the link width divided by the number of lanes. Another complication that may arise is the fact that the IMM requires that each intersection have four approaches: two for each of the two phases. If an actual intersection has fewer than four approaches, then a dummy approach must be specified with a very small volume (i.e., some fraction of a vehicle per hour) or the program will end execution with an error.

The Street Canyon Model is used only for those link-receptor combinations for which the user has indicated a potential of a street canyon, and for which the following test in IMM holds on an hourly basis.

$$H > 7\sqrt{\frac{KW}{u}}$$

Where: H = building height (m)

W = street canyon width (m)

u = wind speed (m/sec)

K = turbulent diffusivity (m^2/sec)

Values for K are 25.5, 5.5, 1.75, 1.0, 0.5, and 0.5 m^2/sec for atmospheric stabilities 1 through 6 (A through F), respectively. Once both of the conditions for a street canyon configuration are met, the concentration assigned to a street canyon receptor will depend upon which side of the street the receptor is located and the direction of the wind with respect to the street orientation.

APPENDIX C

TRAFFIC DATA FOR MONITORING SITES

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Central Ave./Sharon Amity Rd.; X= 0.078 Km;Y= 0.097 Km

Phasing: 7-phase full actuated

(Link) Parameter	Link N(S.A)	E(Cent.)	S(S.A.)	W(Cent.)	Units
Approach Link:					
Beg.X	0.097	0.177	0.065	0.000	Km
Beg.Y	0.197	0.046	0.000	0.137	Km
End X	0.077	0.094	0.079	0.064	Km
End Y	0.116	0.103	0.081	0.099	Km
Width	7.6	7.4	6.9	7.0	Meters
# of Lanes	2	2	2	2	#
Capacity	2800	2700	2400	2800	veh/hr.(Level E)
Speed Limit	45	45	45	45	m.p.h.
Volume	670	1030	1000	1230	veh/hr.
Exit Link:					
Beg.X	0.088	0.089	0.070	0.069	Km
Beg.Y	0.113	0.084	0.085	0.109	Km
End X	0.107	0.172	0.051	0.004	Km
End Y	0.195	0.036	0.003	0.146	Km
Width	7.4	7.1	6.9	6.7	Meters
# of Lanes	2	2	2	2	#
Speed Limit	45	45	45	45	m.p.h.
Volume	980	1000	950	1000	veh/hr.
Receptor Location:					
X	0.080				Km
Y	0.155				Km
Z	3				Meters

DATA FOR MIDBLOCK MODEL Time Period: 10:00 - 16:00

Intersection: First St./Tryon St. (26); X= .083 Km;Y= .068 Km

Phasing: 2-phase, fixed time (coordinated); cycle= 60 sec. (25-First/35 Tryon)

(Link) Parameter	Link N(Tryon)	E(1st)	S(Tryon)	W(1st)	Units
Approach Link:					
Beg.X	0.178	0.147	0.004	0.000	Km
Beg.Y	0.148	0.000	0.000	0.156	Km
End X	0.089	0.094	0.076	0.071	Km
End Y	0.076	0.059	0.058	0.077	Km
Width	7.3	5.8	7.3	9.1	Meters
# of Lanes	2	0	2	2	#
Capacity	3000	0	3000	2500	veh/hr.(Level E)
Speed Limit	35	0	35	35	m.p.h.
Volume	440	0	490	210	veh/hr.
Exit Link:					
Beg.X	0.092	0.094	0.073	0.071	Km
Beg.Y	0.071	0.059	0.063	0.077	Km
End X	0.182	0.147	0.000	0.000	Km
End Y	0.144	0.000	0.005	0.156	Km
Width	7.3	5.8	7.3	9.1	Meters
# of Lanes	2	1	2	0	#
Speed Limit	35	35	35	0	m.p.h.
Volume	560	130	450	0	veh/hr.
Receptor Location:					
X	0.190				Km
Y	0.133				Km
Z	3				Meters

DATA FOR MIDBLOCK MODEL Time Period: 16:00 - 17:00

Intersection: First St./Tryon St. (26); X= .083 Km;Y= .068 Km

Phasing: 2-phase, fixed time (coordinated); cycle= 90 sec. (31-First/59 Tryon)

(Link) Parameter	Link N(Tryon)	E(1st)	S(Tryon)	W(1st)	Units
Approach Link:					
Beg.X	0.178	0.147	0.004	0.000	Km
Beg.Y	0.148	0.000	0.000	0.156	Km
End X	0.089	0.094	0.076	0.071	Km
End Y	0.076	0.059	0.058	0.077	Km
Width	7.3	5.8	7.3	9.1	Meters
# of Lanes	2	0	2	2	#
Capacity	3000	0	3000	2500	veh/hr.(Level E)
Speed Limit	35	0	35	35	m.p.h.
Volume	580	0	590	290	veh/hr.
Exit Link:					
Beg.X	0.092	0.094	0.073	0.071	Km
Beg.Y	0.071	0.059	0.063	0.077	Km
End X	0.182	0.147	0.000	0.000	Km
End Y	0.144	0.000	0.005	0.156	Km
Width	7.3	5.8	7.3	9.1	Meters
# of Lanes	2	1	2	0	#
Speed Limit	35	35	35	0	m.p.h.
Volume	640	190	600	0	veh/hr.
Receptor Location:					
X	0.190				Km
Y	0.133				Km
Z	3				Meters

DATA FOR MIDBLOCK MODEL Time Period: 17:00 - 18:00

Intersection: First St./Tryon St. (26); X= .083 Km;Y= .068 Km

Phasing: 2-phase, fixed time (coordinated); cycle= 90 sec. (31-First/59 Tryon)

(Link) Parameter	Link N(Tryon)	E(1st)	S(Tryon)	W(1st)	Units
Approach Link:					
Beg.X	0.178	0.147	0.004	0.000	Km
Beg.Y	0.148	0.000	0.000	0.156	Km
End X	0.089	0.094	0.076	0.071	Km
End Y	0.076	0.059	0.058	0.077	Km
Width	9.1	5.8	9.1	9.1	Meters
# of Lanes	3	0	3	2	#
Capacity	4000	0	4000	2500	veh/hr.(Level E)
Speed Limit	35	0	35	35	m.p.h.
Volume	600	0	470	410	veh/hr.
Exit Link:					
Beg.X	0.092	0.094	0.073	0.071	Km
Beg.Y	0.071	0.059	0.063	0.077	Km
End X	0.182	0.147	0.000	0.000	Km
End Y	0.144	0.000	0.005	0.156	Km
Width	9.1	5.8	9.1	9.1	Meters
# of Lanes	3	1	3	0	#
Speed Limit	35	35	35	0	m.p.h.
Volume	560	280	660	0	veh/hr.
Receptor Location:					
X	0.190				Km
Y	0.133				Km
Z	3				Meters

DATA FOR MIDBLOCK MODEL Time Period: 10:00 - 16:00

Intersection: Second St./Tryon St.(26); X= 0.186 Km;Y= 0.152 Km

Phasing: 2-phase, fixed time (coordinated); cycle= 60 sec. (25-First/35-Tryon)

(Link) Parameter	Link N(Tryon)	E(2nd)	S(Tryon)	W(2nd)	Units
Approach Link:					
Beg.X	0.271	0.247	0.092	0.097	Km
Beg.Y	0.228	0.092	0.071	0.247	Km
End X	0.192	0.198	0.182	0.176	Km
End Y	0.160	0.142	0.144	0.160	Km
Width	7.3	5.6	7.3	9.4	Meters
# of Lanes	2	2	2	0	#
Capacity	3000	2500	3000	0	veh/hr.(Level E)
Speed Limit	35	35	35	0	m.p.h.
Volume	450	180	560	0	veh/hr.
Exit Link:					
Beg.X	0.196	0.198	0.178	0.176	Km
Beg.Y	0.154	0.142	0.148	0.160	Km
End X	0.271	0.247	0.089	0.097	Km
End Y	0.215	0.092	0.076	0.247	Km
Width	7.3	5.6	7.3	9.4	Meters
# of Lanes	2	0	2	2	#
Speed Limit	35	0	35	35	m.p.h.
Volume	540	0	440	210	veh/hr.
Receptor Location:					
X			0.190		Km
Y			0.133		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL Time Period: 16:00 - 17:00

Intersection: Second St./Tryon St.(30); X= 0.186 Km;Y= 0.152 Km

Phasing: 2-phase, fixed time (coordinated); cycle= 90 sec. (38-Second/52-Tryon)

(Link) Parameter	Link N(Tryon)	E(2nd)	S(Tryon)	W(2nd)	Units
Approach Link:					
Beg.X	0.271	0.247	0.092	0.097	Km
Beg.Y	0.228	0.092	0.071	0.247	Km
End X	0.192	0.198	0.182	0.176	Km
End Y	0.160	0.142	0.144	0.160	Km
Width	7.3	5.6	7.3	9.4	Meters
# of Lanes	2	2	2	0	#
Capacity	3000	2500	3000	0	veh/hr.(Level E)
Speed Limit	35	35	35	0	m.p.h.
Volume	470	320	630	0	veh/hr.
Exit Link:					
Beg.X	0.196	0.198	0.178	0.176	Km
Beg.Y	0.154	0.142	0.148	0.160	Km
End X	0.271	0.247	0.089	0.097	Km
End Y	0.215	0.092	0.076	0.247	Km
Width	7.3	5.6	7.3	9.4	Meters
# of Lanes	2	0	2	2	#
Speed Limit	35	0	35	35	m.p.h.
Volume	630	0	580	190	veh/hr.
Receptor Location:					
X			0.190		Km
Y			0.133		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL Time Period: 17:00 - 18:00

Intersection: Second St./Tryon St.(30); X= 0.186 Km;Y= 0.152 Km

Phasing: 2-phase, fixed time (coordinated); cycle= 90 sec. (38-Second/52-Tryon)

(Link) Parameter	Link N(Tryon)	E(2nd)	S(Tryon)	W(2nd)	Units
Approach Link:					
Beg.X	0.271	0.247	0.092	0.097	Km
Beg.Y	0.228	0.092	0.071	0.247	Km
End X	0.192	0.198	0.182	0.176	Km
End Y	0.160	0.142	0.144	0.160	Km
Width	9.1	5.6	9.1	9.4	Meters
# of Lanes	3	2	3	0	#
Capacity	4000	2500	4000	0	veh/hr.(Level E)
Speed Limit	35	35	35	0	m.p.h.
Volume	470	250	560	0	veh/hr.
Exit Link:					
Beg.X	0.196	0.198	0.178	0.176	Km
Beg.Y	0.154	0.142	0.148	0.160	Km
End X	0.271	0.247	0.089	0.097	Km
End Y	0.215	0.092	0.076	0.247	Km
Width	9.1	5.6	9.1	9.4	Meters
# of Lanes	3	0	3	2	#
Speed Limit	35	0	35	35	m.p.h.
Volume	580	0	590	120	veh/hr.
Receptor Location:					
X			0.190		Km
Y			0.133		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL Time Period: 10:30 - 18:30

Intersection: Park Rd./Woodlawn Rd.; X= 0.102 Km;Y= 0.107 Km

Phasing: 8-phase fully actuated

(Link) Parameter	Link N(Park)	E(Wood.)	S(Park)	W(Wood.)	Units
Approach Link:					
Beg.X	0.107	0.208	0.102	0.000	Km
Beg.Y	0.216	0.103	0.000	0.130	Km
End X	0.100	0.123	0.104	0.080	Km
End Y	0.126	0.110	0.090	0.107	Km
Width	7.0	6.8	7.3	8.1	Meters
# of Lanes	2	2	2	2	#
Capacity	2900	3000	3000	2900	veh/hr.(Level E)
Speed Limit	35	35	35	45	m.p.h.
Volume	750	610	880	900	veh/hr.
Exit Link:					
Beg.X	0.111	0.126	0.09[illegible]	0.083	Km
Beg.Y	0.124	0.097	0.09[illegible]	0.119	Km
End X	0.120	0.209	0.089	0.000	Km
End Y	0.215	0.091	0.000	0.138	Km
Width	7.4	7.3	7.3	7.1	Meters
# of Lanes	2	2	2	2	#
Speed Limit	35	35	35	45	m.p.h.
Volume	840	870	780	650	veh/hr.
Receptor Location:					
X				0.070	Km
Y				0.098	Km
Z				3	Meters

APPENDIX D

SAMPLE IMM-6 PRINTOUTS

```
INTERSECTION-MIDBLOCK MODEL, VERSION 3, LEVEL 15        SITE: CENTRAL/SHARON AMITY
GCA/TECHNOLOGY DIVISION                                       (1987 WITH I&M)


NUMBER OF HOURS FOR THE SIMULATION=    1
NUMBER OF RECEPTORS=    1
NUMBER OF INTERSECTIONS    1
     IPRSW1=1
     IPRSW2=0
     IPRSW3=0
     IPRSW4=1
     IFLAG5=1
     IFLAG6=4
     IDIFLG=0
     IFLAG7=0
     IPRSW8=1


        FOR INTERSECTION  1  NO FREE FLOW CONDITIONS ASSUMED


INTERSECTION    1 IS CONTROLLED BY A DEMAND ACTUATED SIGNAL
        CENTER OF INTERSECTION IS  0.078 KM EAST AND  0.097 KM NORTH


                INPUT DATA FOR LINK    1
        X1 =   0.097     Y1 =   0.197     X2 =   0.077     Y2 =   0.116 KM
        NUMBER OF LANES =  2
        FRACTION OF LINK  1 VOLUME ON LANE  1 = 0.50
        FRACTION OF LINK  1 VOLUME ON LANE  2 = 0.50
        LINK WIDTH =   7.60 METERS          EMISSION HEIGHT = 0.0  METERS
        LINK IS AT GRADE
        LANE CAPACITY = 2800.0 VEHICLES/HOUR     VOLUME =  670.0 VEHICLES/HOUR
        SPEED INTO INTERSECTION = 45.0 MI/HR     SPEED OUT OF INTERSECTION = 45.0 MI/HR
        ACCELERATION INTO INTERSECTION = -2.50 MI/HR/SEC     ACCELERATION OUT OF INTERSECTION =  2.50 MI/HR/SEC


                INPUT DATA FOR LINK    2
        X1 =   0.117     Y1 =   0.046     X2 =   0.094     Y2 =   0.103 KM
        NUMBER OF LANES =  2
```

FRACTION OF LINK 2 VOLUME ON LANE 1 = 0.50

FRACTION OF LINK 2 VOLUME ON LANE 2 = 0.50

LINK WIDTH = 7.40 METERS EMISSION HEIGHT = 0.0 METERS

LINK IS AT GRADE

LANE CAPACITY = 2700.0 VEHICLES/HOUR VOLUME = 1030.0 VEHICLES/HOUR
SPEED INTO INTERSECTION = 45.0 MI/HR SPEED OUT OF INTERSECTION = 45.0 MI/HR
ACCELERATION INTO INTERSECTION = -2.50 MI/HR/SEC ACCELERATION OUT OF INTERSECTION = 2.50 MI/HR/SEC

INPUT DATA FOR LINK 3

X1 = 0.065 Y1 = 0.0 X2 = 0.079 Y2 = 0.081 KM

NUMBER OF LANES = 2

FRACTION OF LINK 3 VOLUME ON LANE 1 = 0.50

FRACTION OF LINK 3 VOLUME ON LANE 2 = 0.50

LINK WIDTH = 6.90 METERS EMISSION HEIGHT = 0.0 METERS

LINK IS AT GRADE

LANE CAPACITY = 2400.0 VEHICLES/HOUR VOLUME = 1000.0 VEHICLES/HOUR
SPEED INTO INTERSECTION = 45.0 MI/HR SPEED OUT OF INTERSECTION = 45.0 MI/HR
ACCELERATION INTO INTERSECTION = -2.50 MI/HR/SEC ACCELERATION OUT OF INTERSECTION = 2.50 MI/HR/SEC

INPUT DATA FOR LINK 4

X1 = 0.0 Y1 = 0.137 X2 = 0.064 Y2 = 0.099 KM

NUMBER OF LANES = 2

FRACTION OF LINK 4 VOLUME ON LANE 1 = 0.50

FRACTION OF LINK 4 VOLUME ON LANE 2 = 0.50

LINK WIDTH = 7.00 METERS EMISSION HEIGHT = 0.0 METERS

LINK IS AT GRADE

LANE CAPACITY = 2800.0 VEHICLES/HOUR VOLUME = 1230.0 VEHICLES/HOUR
SPEED INTO INTERSECTION = 45.0 MI/HR SPEED OUT OF INTERSECTION = 45.0 MI/HR
ACCELERATION INTO INTERSECTION = -2.50 MI/HR/SEC ACCELERATION OUT OF INTERSECTION = 2.50 MI/HR/SEC

THE FOLLOWING DATA APPLIES TO THOSE LINKS WHICH DO NOT APPROACH ANY INTERSECTION

INPUT DATA FOR LINK 5

X1 = 0.088 Y1 = 0.113 .X2 = 0.107 Y2 = 0.195 KM

LINK WIDTH = 7.40 METERS EMISSION HEIGHT = 0.0 METERS

LINK IS AT GRADE

NUMBER OF LANES = 2

FRACTION OF LINK 5 VOLUME ON LANE 1 = 0.50

FRACTION OF LINK 5 VOLUME ON LANE 2 = 0.50

VOLUME= 980.00 VEHICLES/HOUR SPEED= 45.00 MI/HR

INPUT DATA FOR LINK 6

X1 = 0.089 Y1 = 0.084 X2 = 0.172 Y2 = 0.036 KM

LINK WIDTH = 7.10 METERS EMISSION HEIGHT = 0.0 METERS

LINK IS AT GRADE

NUMBER OF LANES = 2

FRACTION OF LINK 6 VOLUME ON LANE 1 = 0.50

FRACTION OF LINK 6 VOLUME ON LANE 2 = 0.50

VOLUME= 1000.00 VEHICLES/HOUR SPEED= 45.00 MI/HR

INPUT DATA FOR LINK 7

X1 = 0.070 Y1 = 0.085 X2 = 0.051 Y2 = 0.003 KM

LINK WIDTH = 6.90 METERS EMISSION HEIGHT = 0.0 METERS

LINK IS AT GRADE

NUMBER OF LANES = 2

FRACTION OF LINK 7 VOLUME ON LANE 1 = 0.50

FRACTION OF LINK 7 VOLUME ON LANE 2 = 0.50

VOLUME= 950.00 VEHICLES/HOUR SPEED= 45.00 MI/HR

INPUT DATA FOR LINK 8

X1 = 0.069 Y1 = 0.109 X2 = 0.004 Y2 = 0.146 KM

LINK WIDTH = 6.70 METERS EMISSION HEIGHT = 0.0 METERS

LINK IS AT GRADE

NUMBER OF LANES = 2

FRACTION OF LINK 8 VOLUME ON LANE 1 = 0.50

FRACTION OF LINK 8 VOLUME ON LANE 2 = 0.50

VOLUME= 1000.00 VEHICLES/HOUR SPEED= 45.00 MI/HR

TOTAL NUMBER OF LINKS IS 8
OF WHICH 4 ARE LINKS WHICH DO NOT APPROACH ANY INTERSECTION

DATA FOR RECEPTOR 1

XX= 0.080 YY= 0.155 Z= 3.00

HOURLY RATIOS OF VOLUME TO AVERAGE VOLUME

1.00

IMM6 RUN FOR INT #2 - 87 IM (CENTRAL/SHARON AMITY)

* TOTAL HC EMISSION FACTORS INCLUDE EVAP. HC EMISSION FACTORS

```
                              VEH. TYPE:  LDV    LDT1  LDT2  HDG    HDD    MC
 CAL. YEAR: 1987      TEMP: 49.0(F)          0.729/0.077/0.046/0.042/0.033/0.009
 REGION: 49-STATE      5.0/ 5.0/ 5.0 MPH ( 5.0) 21.0/ 27.0/ 21.0

  AC:  0.90  XLOAD:    0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
 LDGV I/M PROGRAM STARTING IN 1982
 STRINGENCY LEVEL 25% MECH.TRAINING: YES
 I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
 ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
   I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
                 LDV      LDT1     LDT2      HDG      HDD      MC     ALL MODES
   TOTAL HC:     6.67     10.60     6.68     22.15     7.87    15.60     7.39
EXHAUST  CO:   103.77    144.91    84.94    403.78    35.01   100.11   110.01
EXHAUST NOX:     2.22      2.43     1.70      7.18    29.63     1.06     3.28
```

```
                              VEH. TYPE:  LDV    LDT1  LDT2  HDG    HDD    MC
 CAL. YEAR: 1987      TEMP: 75.0(F)          1.000/0.0  /0.0  /0.0  /0.0  /0.0
 REGION: 49-STATE      5.0/ 5.0/ 5.0 MPH ( 5.0)  0.0/  0.0/  0.0

  AC:  0.90  XLOAD:    0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
 LDGV I/M PROGRAM STARTING IN 1982
 STRINGENCY LEVEL 25% MECH.TRAINING: YES
 I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
 ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
   I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
                 LDV      LDT1     LDT2      HDG      HDD      MC     ALL MODES
 TOTAL HC:       5.61      0.0      0.0       0.0      0.0      0.0      5.61
EXHAUST  CO:    81.25      0.0      0.0       0.0      0.0      0.0     81.25
EXHAUST NOX:     1.56      0.0      0.0       0.0      0.0      0.0      1.56
```

```
CAUTION: IM,TRUCK,OR ALH CORRECTION CALLED FOR
IDLE EMISSIONS CALCULATED BY ALTERNATE METHOD
IDLING EMISSIONS=      0.1924E+00 GM/VEHICLE/SEC
   COR.RATIO IS
              ACCELERATION EMISSIONS DECELERATION EMISSIONS       CRUISE EMISSIONS
INS PH APP LNK+    CORRECTED    RATIO+    CORRECTED    RATIO+    CORRECTED    RATIO+
                              VEH. TYPE:  LDV    LDT1  LDT2  HDG    HDD    MC
 CAL. YEAR: 1987      TEMP: 49.0(F)          0.729/0.077/0.046/0.042/0.033/0.009
 REGION: 49-STATE    22.5/22.5/22.5 MPH (22.5) 21.0/ 27.0/ 21.0

  AC:  0.90  XLOAD:    0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
 LDGV I/M PROGRAM STARTING IN 1982
 STRINGENCY LEVEL 25% MECH.TRAINING: YES
 I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
 ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
   I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
                 LDV      LDT1     LDT2      HDG      HDD      MC     ALL MODES
   TOTAL HC:     2.01      3.15     1.91      7.38     3.72     6.10     2.32
EXHAUST  CO:    29.39     40.55    22.84    123.38    11.63    20.95    31.45
EXHAUST NOX:     2.87      3.12     2.19      8.46    18.00     1.12     3.46
```

```
                                VEH. TYPE:  LDV    LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1977      TEMP: 75.0(F)          1.000/0.0  /0.0  /0.0  /0.0  /0.0
REGION: 49-STATE     22.5/22.5/22.5 MPH (22.5)  0.0/  0.0/  0.0

 AC:  0.90  XLOAD:   0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
  I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
              LDV      LDT1     LDT2     HDG      HDD      MC     ALL MODES
  TOTAL HC:    4.89     0.0      0.0      0.0      0.0      0.0      4.89
EXHAUST  CO:  62.95     0.0      0.0      0.0      0.0      0.0     62.95
EXHAUST NOX:   3.70     0.0      0.0      0.0      0.0      0.0      3.70
-------------------------------------------------------------------------------
                                VEH. TYPE:  LDV    LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1987      TEMP: 49.0(F)          0.729/0.077/0.046/0.042/0.033/0.009
REGION: 49-STATE     22.5/22.5/22.5 MPH (22.5) 21.0/ 27.0/ 21.0

 AC:  0.90  XLOAD:   0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
  I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
              LDV      LDT1     LDT2     HDG      HDD      MC     ALL MODES
  TOTAL HC:    2.01     3.15     1.91     7.38     3.72     6.10     2.32
EXHAUST  CO:  29.39    40.55    22.84   123.38    11.63    20.95    31.45
EXHAUST NOX:   2.87     3.12     2.19     8.46    18.00     1.12     3.46
-------------------------------------------------------------------------------
                                VEH. TYPE:  LDV    LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1977      TEMP: 75.0(F)          1.000/0.0  /0.0  /0.0  /0.0  /0.0
REGION: 49-STATE     22.5/22.5/22.5 MPH (22.5)  0.0/  0.0/  0.0

 AC:  0.90  XLOAD:   0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
  I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
              LDV      LDT1     LDT2     HDG      HDD      MC     ALL MODES
  TOTAL HC:    4.89     0.0      0.0      0.0      0.0      0.0      4.89
EXHAUST  CO:  62.95     0.0      0.0      0.0      0.0      0.0     62.95
EXHAUST NOX:   3.70     0.0      0.0      0.0      0.0      0.0      3.70
-------------------------------------------------------------------------------
                                VEH. TYPE:  LDV    LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1987      TEMP: 49.0(F)          0.729/0.077/0.046/0.042/0.033/0.009
REGION: 49-STATE     45.0/45.0/45.0 MPH (45.0) 21.0/ 27.0/ 21.0

 AC:  0.90  XLOAD:   0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
```

ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

COMPOSITE EMISSION FACTORS (GM/MILE)

	LDV	LDT1	LDT2	HDG	HDD	MC	ALL MODES
TOTAL HC:	1.14	1.75	1.04	4.04	2.10	4.65	1.31
EXHAUST CO:	15.35	21.10	11.77	72.30	6.40	9.93	16.74
EXHAUST NOX:	3.69	4.00	2.78	10.09	17.97	1.45	4.22

VEH. TYPE: LDV LDT1 LDT2 HDG HDD MC
CAL. YEAR: 1977 TEMP: 75.0(F) 1.000/0.0 /0.0 /0.0 /0.0 /0.0
REGION: 49-STATE 45.0/45.0/45.0 MPH (45.0) 0.0/ 0.0/ 0.0

AC: 0.90 XLOAD: 0.08 0.12 0.14 TRAILR: 0.09 ABSHUM: 43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

COMPOSITE EMISSION FACTORS (GM/MILE)

	LDV	LDT1	LDT2	HDG	HDD	MC	ALL MODES
TOTAL HC:	3.51	0.0	0.0	0.0	0.0	0.0	3.51
EXHAUST CO:	33.43	0.0	0.0	0.0	0.0	0.0	33.43
EXHAUST NOX:	4.49	0.0	0.0	0.0	0.0	0.0	4.49

1 1 1 + 11.7370625 0.4995+ 2.85909557 0.4995+ 0.275278926 0.5009+
VEH. TYPE: LDV LDT1 LDT2 HDG HDD MC
CAL. YEAR: 1987 TEMP: 49.0(F) 0.729/0.077/0.046/0.042/0.033/0.009
REGION: 49-STATE 22.5/22.5/22.5 MPH (22.5) 21.0/ 27.0/ 21.0

AC: 0.90 XLOAD: 0.08 0.12 0.14 TRAILR: 0.09 ABSHUM: 43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

COMPOSITE EMISSION FACTORS (GM/MILE)

	LDV	LDT1	LDT2	HDG	HDD	MC	ALL MODES
TOTAL HC:	2.01	3.15	1.91	7.38	3.72	6.10	2.32
EXHAUST CO:	29.39	40.55	22.84	123.38	11.63	20.95	31.45
EXHAUST NOX:	2.87	3.12	2.19	8.46	18.00	1.12	3.46

VEH. TYPE: LDV LDT1 LDT2 HDG HDD MC
CAL. YEAR: 1977 TEMP: 75.0(F) 1.000/0.0 /0.0 /0.0 /0.0 /0.0
REGION: 49-STATE 22.5/22.5/22.5 MPH (22.5) 0.0/ 0.0/ 0.0

AC: 0.90 XLOAD: 0.08 0.12 0.14 TRAILR: 0.09 ABSHUM: 43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

COMPOSITE EMISSION FACTORS (GM/MILE)

	LDV	LDT1	LDT2	HDG	HDD	MC	ALL MODES
TOTAL HC:	4.89	0.0	0.0	0.0	0.0	0.0	4.89
EXHAUST CO:	62.95	0.0	0.0	0.0	0.0	0.0	62.95
EXHAUST NOX:	3.70	0.0	0.0	0.0	0.0	0.0	3.70

```
                                VEH. TYPE:  LDV    LDT1  LDT2  HDG    HDD    MC
CAL. YEAR: 1987      TEMP: 49.0(F)          0.729/0.077/0.046/0.042/0.033/0.009
REGION: 49-STATE     22.5/22.5/22.5 MPH (22.5) 21.0/ 27.0/ 21.0

 AC:  0.90  XLOAD:    0.08    0.12    0.14  TRAILR:    0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
  I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
                LDV       LDT1      LDT2      HDG       HDD       MC     ALL MODES
   TOTAL HC:     2.01      3.15      1.91      7.38      3.72      6.10      2.32
EXHAUST  CO:    29.39     40.55     22.84    123.38     11.63     20.95     31.45
EXHAUST NOX:     2.87      3.12      2.19      8.46     18.00      1.12      3.46
-------------------------------------------------------------------------------
                                VEH. TYPE:  LDV    LDT1  LDT2  HDG    HDD    MC
CAL. YEAR: 1977      TEMP: 75.0(F)          1.000/0.0  /0.0  /0.0  /0.0  /0.0
REGION: 49-STATE     22.5/22.5/22.5 MPH (22.5)  0.0/  0.0/  0.0

 AC:  0.90  XLOAD:    0.08    0.12    0.14  TRAILR:    0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
  I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
                LDV       LDT1      LDT2      HDG       HDD       MC     ALL MODES
   TOTAL HC:     4.89      0.0       0.0       0.0       0.0       0.0       4.89
EXHAUST  CO:    62.95      0.0       0.0       0.0       0.0       0.0      62.95
EXHAUST NOX:     3.70      0.0       0.0       0.0       0.0       0.0       3.70
-------------------------------------------------------------------------------
                                VEH. TYPE:  LDV    LDT1  LDT2  HDG    HDD    MC
CAL. YEAR: 1987      TEMP: 49.0(F)          0.729/0.077/0.046/0.042/0.033/0.009
REGION: 49-STATE     45.0/45.0/45.0 MPH (45.0) 21.0/ 27.0/ 21.0

 AC:  0.90  XLOAD:    0.08    0.12    0.14  TRAILR:    0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
  I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
                LDV       LDT1      LDT2      HDG       HDD       MC     ALL MODES
   TOTAL HC:     1.14      1.75      1.04      4.04      2.10      4.65      1.31
EXHAUST  CO:    15.35     21.10     11.77     72.30      6.40      9.93     16.74
EXHAUST NOX:     3.69      4.00      2.78     10.09     17.97      1.45      4.22
-------------------------------------------------------------------------------
                                VEH. TYPE:  LDV    LDT1  LDT2  HDG    HDD    MC
CAL. YEAR: 1977      TEMP: 75.0(F)          1.000/0.0  /0.0  /0.0  /0.0  /0.0
REGION: 49-STATE     45.0/45.0/45.0 MPH (45.0)  0.0/  0.0/  0.0

 AC:  0.90  XLOAD:    0.08    0.12    0.14  TRAILR:    0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
```

```
 ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
   I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                        COMPOSITE EMISSION FACTORS (GM/MILE)
                  LDV       LDT1      LDT2      HDG       HDD       MC     ALL MODES
    TOTAL HC:     3.51       0.0       0.0       0.0       0.0       0.0       3.51
EXHAUST  CO:     33.43       0.0       0.0       0.0       0.0       0.0      33.43
EXHAUST NOX:      4.49       0.0       0.0       0.0       0.0       0.0       4.49
-------------------------------------------------------------------------------
 1   1   2    + 11.7370625      0.4995+  2.85909557     0.4995+  0.275278926   0.5009+
                                VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
 CAL. YEAR: 1937      TEMP: 49.0(F)          0.729/0.077/0.046/0.042/0.033/0.009
 REGION: 49-STATE     22.5/22.5/22.5 MPH (22.5) 21.0/ 27.0/ 21.0

  AC:  0.90  XLOAD:    0.08    0.12    0.14  TRAILR:    0.09  ABSHUM:  43.00
 LDGV I/M PROGRAM STARTING IN 1982
 STRINGENCY LEVEL 25% MECH.TRAINING: YES
 I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
 ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
   I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                        COMPOSITE EMISSION FACTORS (GM/MILE)
                  LDV       LDT1      LDT2      HDG       HDD       MC     ALL MODES
    TOTAL HC:     2.01       3.15      1.91      7.38      3.72      6.10      2.32
EXHAUST  CO:     29.39      40.55     22.84    123.38     11.63     20.95     31.45
EXHAUST NOX:      2.87       3.12      2.19      8.46     18.00      1.12      3.46
-------------------------------------------------------------------------------
                                VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
 CAL. YEAR: 1977      TEMP: 75.0(F)          1.000/0.0  /0.0  /0.0  /0.0  /0.0
 REGION: 49-STATE     22.5/22.5/22.5 MPH (22.5)  0.0/  0.0/  0.0

  AC:  0.90  XLOAD:    0.08    0.12    0.14  TRAILR:    0.09  ABSHUM:  43.00
 LDGV I/M PROGRAM STARTING IN 1982
 STRINGENCY LEVEL 25% MECH.TRAINING: YES
 I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
 ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
   I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                        COMPOSITE EMISSION FACTORS (GM/MILE)
                  LDV       LDT1      LDT2      HDG       HDD       MC     ALL MODES
    TOTAL HC:     4.89       0.0       0.0       0.0       0.0       0.0       4.89
EXHAUST  CO:     62.95       0.0       0.0       0.0       0.0       0.0      62.95
EXHAUST NOX:      3.70       0.0       0.0       0.0       0.0       0.0       3.70
-------------------------------------------------------------------------------
                                VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
 CAL. YEAR: 1987      TEMP: 49.0(F)          0.729/0.077/0.046/0.042/0.033/0.009
 REGION: 49-STATE     22.5/22.5/22.5 MPH (22.5) 21.0/ 27.0/ 21.0

  AC:  0.90  XLOAD:    0.08    0.12    0.14  TRAILR:    0.09  ABSHUM:  43.00
 LDGV I/M PROGRAM STARTING IN 1982
 STRINGENCY LEVEL 25% MECH.TRAINING: YES
 I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
 ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
   I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                        COMPOSITE EMISSION FACTORS (GM/MILE)
                  LDV       LDT1      LDT2      HDG       HDD       MC     ALL MODES
    TOTAL HC:     2.01       3.15      1.91      7.38      3.72      6.10      2.32
EXHAUST  CO:     29.39      40.55     22.84    123.38     11.63     20.95     31.45
EXHAUST NOX:      2.87       3.12      2.19      8.46     18.00      1.12      3.46
```

```
                                VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1977      TEMP: 75.0(F)          1.000/0.0  /0.0  /0.0  /0.0  /0.0
REGION: 49-STATE     22.5/22.5/22.5 MPH (22.5)  0.0/  0.0/  0.0

 AC:  0.90  XLOAD:   0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
  I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
               LDV      LDT1     LDT2     HDG      HDD      MC     ALL MODES
  TOTAL HC:   4.89       0.0      0.0      0.0      0.0      0.0       4.89
EXHAUST  CO:  62.95       0.0      0.0      0.0      0.0      0.0      62.95
EXHAUST NOX:   3.70       0.0      0.0      0.0      0.0      0.0       3.70
--------------------------------------------------------------------------------
                                VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1987      TEMP: 49.0(F)          0.729/0.077/0.046/0.042/0.033/0.009
REGION: 49-STATE     45.0/45.0/45.0 MPH (45.0) 21.0/ 27.0/ 21.0

 AC:  0.90  XLOAD:   0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
  I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
               LDV      LDT1     LDT2     HDG      HDD      MC     ALL MODES
  TOTAL HC:   1.14       1.75     1.04     4.04     2.10     4.65      1.31
EXHAUST  CO:  15.35      21.10    11.77    72.30     6.40     9.93     16.74
EXHAUST NOX:   3.69       4.00     2.78    10.09    17.97     1.45      4.22
--------------------------------------------------------------------------------
                                VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1977      TEMP: 75.0(F)          1.000/0.0  /0.0  /0.0  /0.0  /0.0
REGION: 49-STATE     45.0/45.0/45.0 MPH (45.0)  0.0/  0.0/  0.0

 AC:  0.90  XLOAD:   0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
  I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
               LDV      LDT1     LDT2     HDG      HDD      MC     ALL MODES
  TOTAL HC:   3.51       0.0      0.0      0.0      0.0      0.0       3.51
EXHAUST  CO:  33.43       0.0      0.0      0.0      0.0      0.0      33.43
EXHAUST NOX:   4.49       0.0      0.0      0.0      0.0      0.0       4.49
--------------------------------------------------------------------------------
1   2   1    + 11.7370625      0.4995+  2.85909557     0.4995+  0.275278926    0.5009+
                                VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1987      TEMP: 49.0(F)          0.729/0.077/0.046/0.042/0.033/0.009
REGION: 49-STATE     22.5/22.5/22.5 MPH (22.5) 21.0/ 27.0/ 21.0

 AC:  0.90  XLOAD:   0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
```

I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

COMPOSITE EMISSION FACTORS (GM/MILE)

	LDV	LDT1	LDT2	HDG	HDD	MC	ALL MODES
TOTAL HC:	2.01	3.15	1.91	7.38	3.72	6.10	2.32
EXHAUST CO:	29.39	40.55	22.84	123.38	11.63	20.95	31.45
EXHAUST NOX:	2.87	3.12	2.19	8.46	18.00	1.12	3.46

	VEH. TYPE:	LDV	LDT1	LDT2	HDG	HDD	MC
CAL. YEAR: 1977	TEMP: 75.0(F)	1.000/0.0	/0.0	/0.0	/0.0	/0.0	/0.0
REGION: 49-STATE	22.5/22.5/22.5 MPH (22.5)	0.0/	0.0/	0.0			

AC: 0.90 XLOAD: 0.08 0.12 0.14 TRAILR: 0.09 ABSHUM: 43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

COMPOSITE EMISSION FACTORS (GM/MILE)

	LDV	LDT1	LDT2	HDG	HDD	MC	ALL MODES
TOTAL HC:	4.89	0.0	0.0	0.0	0.0	0.0	4.89
EXHAUST CO:	62.95	0.0	0.0	0.0	0.0	0.0	62.95
EXHAUST NOX:	3.70	0.0	0.0	0.0	0.0	0.0	3.70

	VEH. TYPE:	LDV	LDT1	LDT2	HDG	HDD	MC
CAL. YEAR: 1987	TEMP: 49.0(F)	0.729/0.077/0.046/0.042/0.033/0.009					
REGION: 49-STATE	22.5/22.5/22.5 MPH (22.5)	21.0/	27.0/	21.0			

AC: 0.90 XLOAD: 0.08 0.12 0.14 TRAILR: 0.09 ABSHUM: 43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

COMPOSITE EMISSION FACTORS (GM/MILE)

	LDV	LDT1	LDT2	HDG	HDD	MC	ALL MODES
TOTAL HC:	2.01	3.15	1.91	7.38	3.72	6.10	2.32
EXHAUST CO:	29.39	40.55	22.84	123.38	11.63	20.95	31.45
EXHAUST NOX:	2.87	3.12	2.19	8.46	18.00	1.12	3.46

	VEH. TYPE:	LDV	LDT1	LDT2	HDG	HDD	MC
CAL. YEAR: 1977	TEMP: 75.0(F)	1.000/0.0	/0.0	/0.0	/0.0	/0.0	/0.0
REGION: 49-STATE	22.5/22.5/22.5 MPH (22.5)	0.0/	0.0/	0.0			

AC: 0.90 XLOAD: 0.08 0.12 0.14 TRAILR: 0.09 ABSHUM: 43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

COMPOSITE EMISSION FACTORS (GM/MILE)

	LDV	LDT1	LDT2	HDG	HDD	MC	ALL MODES
TOTAL HC:	4.89	0.0	0.0	0.0	0.0	0.0	4.89
EXHAUST CO:	62.95	0.0	0.0	0.0	0.0	0.0	62.95
EXHAUST NOX:	3.70	0.0	0.0	0.0	0.0	0.0	3.70

```
                                VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
 CAL. YEAR: 1987      TEMP: 49.0(F)          0.729/0.077/0.046/0.042/0.033/0.009
 REGION: 49-STATE     45.0/45.0/45.0 MPH (45.0) 21.0/ 27.0/ 21.0

  AC:  0.90  XLOAD:    0.08    0.12    0.14  TRAILR:    0.09  ABSHUM:  43.00
 LDGV I/M PROGRAM STARTING IN 1982
 STRINGENCY LEVEL 25% MECH.TRAINING: YES
 I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
 ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
   I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                     COMPOSITE EMISSION FACTORS (GM/MILE)
                LDV      LDT1     LDT2      HDG      HDD      MC     ALL MODES
   TOTAL HC:     1.14     1.75     1.04     4.04     2.10     4.65      1.31
EXHAUST  CO:    15.35    21.10    11.77    72.30     6.40     9.93     16.74
EXHAUST NOX:     3.69     4.00     2.78    10.09    17.97     1.45      4.22
------------------------------------------------------------------------------
                                VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
 CAL. YEAR: 1977      TEMP: 75.0(F)          1.000/0.0  /0.0  /0.0  /0.0  /0.0
 REGION: 49-STATE     45.0/45.0/45.0 MPH (45.0)  0.0/  0.0/  0.0

  AC:  0.90  XLOAD:    0.08    0.12    0.14  TRAILR:    0.09  ABSHUM:  43.00
 LDGV I/M PROGRAM STARTING IN 1982
 STRINGENCY LEVEL 25% MECH.TRAINING: YES
 I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
 ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
   I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                     COMPOSITE EMISSION FACTORS (GM/MILE)
                LDV      LDT1     LDT2      HDG      HDD      MC     ALL MODES
   TOTAL HC:     3.51     0.0      0.0      0.0      0.0      0.0       3.51
EXHAUST  CO:    33.43     0.0      0.0      0.0      0.0      0.0      33.43
EXHAUST NOX:     4.49     0.0      0.0      0.0      0.0      0.0       4.49
------------------------------------------------------------------------------
 1   2   2    + 11.7370625      0.4995+  2.85909557     0.4995+  0.275278926    0.5009+
                                VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
 CAL. YEAR: 1987      TEMP: 49.0(F)          0.729/0.077/0.046/0.042/0.033/0.009
 REGION: 49-STATE     45.0/45.0/45.0 MPH (45.0) 21.0/ 27.0/ 21.0

  AC:  0.90  XLOAD:    0.08    0.12    0.14  TRAILR:    0.09  ABSHUM:  43.00
 LDGV I/M PROGRAM STARTING IN 1982
 STRINGENCY LEVEL 25% MECH.TRAINING: YES
 I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
 ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
   I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                     COMPOSITE EMISSION FACTORS (GM/MILE)
                LDV      LDT1     LDT2      HDG      HDD      MC     ALL MODES
   TOTAL HC:     1.14     1.75     1.04     4.04     2.10     4.65      1.31
EXHAUST  CO:    15.35    21.10    11.77    72.30     6.40     9.93     16.74
EXHAUST NOX:     3.69     4.00     2.78    10.09    17.97     1.45      4.22
------------------------------------------------------------------------------
                                VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
 CAL. YEAR: 1977      TEMP: 75.0(F)          1.000/0.0  /0.0  /0.0  /0.0  /0.0
 REGION: 49-STATE     45.0/45.0/45.0 MPH (45.0)  0.0/  0.0/  0.0

  AC:  0.90  XLOAD:    0.08    0.12    0.14  TRAILR:    0.09  ABSHUM:  43.00
 LDGV I/M PROGRAM STARTING IN 1982
 STRINGENCY LEVEL 25% MECH.TRAINING: YES
```

I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

COMPOSITE EMISSION FACTORS (GM/MILE)

	LDV	LDT1	LDT2	HDG	HDD	MC	ALL MODES
TOTAL HC:	3.51	0.0	0.0	0.0	0.0	0.0	3.51
EXHAUST CO:	33.43	0.0	0.0	0.0	0.0	0.0	33.43
EXHAUST NOX:	4.49	0.0	0.0	0.0	0.0	0.0	4.49

VEH. TYPE: LDV LDT1 LDT2 HDG HDD MC
CAL. YEAR: 1987 TEMP: 49.0(F) 0.729/0.077/0.046/0.042/0.033/0.009
REGION: 49-STATE 45.0/45.0/45.0 MPH (45.0) 21.0/ 27.0/ 21.0

AC: 0.90 XLOAD: 0.08 0.12 0.14 TRAILR: 0.09 ABSHUM: 43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

COMPOSITE EMISSION FACTORS (GM/MILE)

	LDV	LDT1	LDT2	HDG	HDD	MC	ALL MODES
TOTAL HC:	1.14	1.75	1.04	4.04	2.10	4.65	1.31
EXHAUST CO:	15.35	21.10	11.77	72.30	6.40	9.93	16.74
EXHAUST NOX:	3.69	4.00	2.78	10.09	17.97	1.45	4.22

VEH. TYPE: LDV LD[illegible]T2 HDG HDD MC
CAL. YEAR: 1977 TEMP: 75.0(F) 1.000/0.0 /0.0 /0.0 /0.0 /0.0
REGION: 49-STATE 45.0/45.0/45.0 MPH (45.0) 0.0/ 0.0/ 0.0

AC: 0.90 XLOAD: 0.08 0.12 0.14 TRAILR: 0.09 ABSHUM: 43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

COMPOSITE EMISSION FACTORS (GM/MILE)

	LDV	LDT1	LDT2	HDG	HDD	MC	ALL MODES
TOTAL HC:	3.51	0.0	0.0	0.0	0.0	0.0	3.51
EXHAUST CO:	33.43	0.0	0.0	0.0	0.0	0.0	33.43
EXHAUST NOX:	4.49	0.0	0.0	0.0	0.0	0.0	4.49

VEH. TYPE: LDV LDT1 LDT2 HDG HDD MC
CAL. YEAR: 1987 TEMP: 49.0(F) 0.729/0.077/0.046/0.042/0.033/0.009
REGION: 49-STATE 45.0/45.0/45.0 MPH (45.0) 21.0/ 27.0/ 21.0

AC: 0.90 XLOAD: 0.08 0.12 0.14 TRAILR: 0.09 ABSHUM: 43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

COMPOSITE EMISSION FACTORS (GM/MILE)

	LDV	LDT1	LDT2	HDG	HDD	MC	ALL MODES
TOTAL HC:	1.14	1.75	1.04	4.04	2.10	4.65	1.31
EXHAUST CO:	15.35	21.10	11.77	72.30	6.40	9.93	16.74
EXHAUST NOX:	3.69	4.00	2.78	10.09	17.97	1.45	4.22

```
                                    VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1977      TEMP: 75.0(F)          1.000/0.0  /0.0  /0.0  /0.0  /0.0
REGION: 49-STATE     45.0/45.0/45.0 MPH (45.0)  0.0/  0.0/  0.0

 AC:  0.90  XLOAD:   0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
  I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
                LDV      LDT1     LDT2     HDG      HDD      MC     ALL MODES
  TOTAL HC:    3.51      0.0      0.0      0.0      0.0      0.0       3.51
EXHAUST  CO:  33.43      0.0      0.0      0.0      0.0      0.0      33.43
EXHAUST NOX:   4.49      0.0      0.0      0.0      0.0      0.0       4.49
-------------------------------------------------------------------------------
                                    VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1987      TEMP: 49.0(F)          0.729/0.077/0.046/0.042/0.033/0.009
REGION: 49-STATE     45.0/45.0/45.0 MPH (45.0) 21.0/ 27.0/ 21.0

 AC:  0.90  XLOAD:   0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
  I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
                LDV      LDT1     LDT2     HDG      HDD      MC     ALL MODES
  TOTAL HC:    1.14      1.75     1.04     4.04     2.10     4.65      1.31
EXHAUST  CO:  15.35     21.10    11.77    72.30     6.40     9.93     16.74
EXHAUST NOX:   3.69      4.00     2.78    10.09    17.97     1.45      4.22
-------------------------------------------------------------------------------
                                    VEH. TYPE:  LDV   LDT1  LDT2  HDG   HDD   MC
CAL. YEAR: 1977      TEMP: 75.0(F)          1.000/0.0  /0.0  /0.0  /0.0  /0.0
REGION: 49-STATE     45.0/45.0/45.0 MPH (45.0)  0.0/  0.0/  0.0

 AC:  0.90  XLOAD:   0.08   0.12   0.14  TRAILR:   0.09  ABSHUM:  43.00
LDGV I/M PROGRAM STARTING IN 1982
STRINGENCY LEVEL 25% MECH.TRAINING: YES
I/M PROGRAM BENEFITS APPLY ONLY TO MODEL YEARS 1975 THROUGH 1987
ATTENTION: THE DEFAULT VALUE OF 50% FOR TECHNOLOGY 4
  I/M IDENTIFICATION RATE HAS BEEN LEFT UNCHANGED.

                    COMPOSITE EMISSION FACTORS (GM/MILE)
                LDV      LDT1     LDT2     HDG      HDD      MC     ALL MODES
  TOTAL HC:    3.51      0.0      0.0      0.0      0.0      0.0       3.51
EXHAUST  CO:  33.43      0.0      0.0      0.0      0.0      0.0      33.43
EXHAUST NOX:   4.49      0.0      0.0      0.0      0.0      0.0       4.49
-------------------------------------------------------------------------------
```

SUMMARY OF HOURLY INPUT DATA:

HOUR	W DIR (DEG)	SPEED (M/S)	HEIGHT (M)	STAB CLAS	TEMP (DEG)	HOT START	COLD START	---LINK VOL--- 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	180.	2.00	60.	6	49.	27.0	21.0	670.	1030.	1000.	1230.	0.	0.	0.	0.	980.	1000.	950.	1000.	0.	0.

TRAFFIC OPERATIONS SUMMARY:

INS	PH	APP	LNK	+	SIG	NQND	LANE VOL	CAP	GAP	CY	G	+	DELAY	QUEUE(V)	QUEUE(DIS)	+
1	1	1	1	+	1	0	335.0	2800.	0.	39.	15.	+	9.8	3.0	23.8	+
1	1	2	2	+	1	0	515.0	2700.	0.	39.	15.	+	12.4	5.2	41.5	+
1	2	1	3	+	1	0	500.0	2400.	0.	39.	18.	+	10.0	4.5	36.3	+
1	2	2	4	+	1	0	615.0	2800.	0.	39.	18.	+	9.9	5.5	44.4	+

PSEUDOLINK EMISSION RATE CALCULATION SUMMARY:

INS	PH	APP	LINK DIST (M)	LINK AC DC (G/M-S)	LINK CRUISE (G/M-S)	EXCESS EMISSIONS TOTAL (G/S)	EXCESS EMISSIONS DIS (M)	EXCESS EMISSIONS RATE (G/M-S)	IDLE EMISSIONS TOTAL (G/S)	IDLE EMISSIONS DIS (M)	IDLE EMISSIONS RATE (G/M-S)	PSEUDOLINK DIST (M)	PSEUDOLINK RATE (G/M-S)	PSEUDOLINK NUM	LINK AND LANE	EMISSION RATE (G/M-S)
1	1	1	83.4	0.002923	0.000992	0.7340	380.2	0.0019	0.3502	23.8	0.0147	40.0	0.02711	9		
1	1	2	61.5	0.005106	0.001733	1.2824	380.2	0.0034	0.6802	41.5	0.0164	41.5	0.04728	10		
1	2	1	82.2	0.004468	0.001517	1.1222	380.2	0.0030	0.5322	36.3	0.0147	40.0	0.04136	11		
1	2	2	74.4	0.005458	0.001853	1.3708	380.2	0.0036	0.6519	44.4	0.0147	44.4	0.04559	12		

HOUR 1 ORIGINAL HIWAY CONTRIBUTIONS PRIOR TO REPLACEMENT

RECEPTOR	CONTRIBUTION FROM LINK																						****TOTAL****	
NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	MG/M**3	PPM
1	0.43	0.00	0.82	0.00	0.05	0.02	0.09	0.00	4.60	0.06	6.33	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.40	

HOUR 1 FINAL CONTRIBUTIONS AND CONCENTRATIONS

RECEPTOR	CONTRIBUTION FROM LINK																						****TOTAL****	
NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	MG/M**3	PPM
1	0.43	0.00	0.82	0.00	0.05	0.02	0.09	0.00	4.60	0.06	6.33	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.40	10.790

APPENDIX E

ADDITIONAL HOT SPOT ANALYSIS

APPENDIX E

In addition to the air quality analyses for three monitoring sites, 26 other intersections were analyzed for possible violation of the CO standards. These intersections to be analyzed were selected by the City of Charlotte, Department of Transportation on the basis of traffic volumes.

These intersections were first analyzed for 1983 conditions with the benefits of I&M programs. Those intersections with 1983 projected air quality substantially higher than the standards were analyzed for 1987 conditions. The results are summarized in Table E.1, and the traffic parameters for these intersections used in the analysis are given in this Appendix.

The results indicate possible violation of the CO standard in 1987 at three sites as listed below.

1. Albemarle-Sharon Amity
2. Independence-Sharon Amity
3. Idlewild-Independence

TABLE E.1

PROJECTED AIR QUALITY[a]

Site Description (Intersection Number)	8-Hour CO (mg/m^3) 1983 With I&M	1987 With I&M
1. Albemarle-Sharon Amity (444)	15.2	10.4
2. Eastway-Monroe (474)	9.1	----
3. Central-Kilborne (458)	11.0	----
4. Rama-Sardis (494)	9.1	----
5. Providence-Queens (506)	4.9	----
6. Providence-Sharon Amity (509)	9.0	----
7. Fairview-Park (657)	7.3	----
8. Providence-Wendover (508)	9.9	----
9. Independence-Sharon Amity (446)	15.6	10.8
10. Fairview-Providence (510)	10.5	----
11. Central-Eastway (457)	11.6	----
12. Sugar Creek-Tryon (212)	5.4	----
13. Tryon-Orr (283)	3.8	----
14. Idlewild-Lawyers (553)	2.4	----
15. Archdale-South Boulevard (628)	8.8	----
16. South Boulevard-Tyvola (625)	8.4	----
17. Graham-I-85 (262)	8.4	----
18. Lasalle-I-77 (901)	5.1	----
19. Independence-Seventh (414)	6.5	----
20. Brookshire-I-85 (875)	4.7	----
21. I-85-Sugar Creek (229)	10.4	----
22. Hawthorne-Independence (421)	8.1	----
23. Central-Hawthorne (422)	4.5	----
24. Freedom-Ashley (852)	2.3	----
25. Idlewild-Independence (448)	15.9	11.2
26. Beatties Ford-Rozzelles Ferry (813)	12.1	----

[a] Includes background of 1.5 mg/m^3 and 2.0 mg/m^3 for 1987 and 1983, respectively.

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Albemarle/Sharon Amity (444); X= 0.141 Km;Y= 0.132 Km

Phasing: 5-phase full actuated

(Link) Parameter	Link N(S.A.)	E(Albe.)	S(S.A.)	W(Albe.)	Units
Approach Link:					
Beg.X	0.142	0.228	0.141	0.050	Km
Beg.Y	0.245	0.180	0.023	0.092	Km
End X	0.136	0.157	0.146	0.124	Km
End Y	0.150	0.147	0.114	0.117	Km
Width	7	7.5	6.5	7	Meters
# of Lanes	2	2	2	2	#
Capacity	3000	3000	2800	3000	
Speed Limit	45	45	45	45	m.p.h.
Volume	840	830	1140	920	veh/hr.
Exit Link:					
Beg.X	0.147	0.156	0.135	0.121	Km
Beg.Y	0.152	0.134	0.114	0.130	Km
End X	0.154	0.232	0.131	0.046	Km
End Y	0.250	0.170	0.018	0.093	Km
Width	6	7.5	7	8	Meters
# of Lanes	2	2	2	2	#
Speed Limit	45	45	45	45	m.p.h.
Volume	990	1100	970	660	veh/hr.
Receptor Location:					
X		0.199			Km
Y		0.184			Km
Z		3			Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Independence/Sharon Amity (446) X= 0.092 Km;Y= 0.105 Km

Phasing: 8-phase full actuated

(Link) Parameter	Link N(S. A.)	E(Indep)	S(S. A.)	W(Indep)	Units
Approach Link:					
Beg.X	0.157	0.191	0.038	0.000	Km
Beg.Y	0.203	0.000	0.009	0.202	Km
End X	0.100	0.110	0.082	0.072	Km
End Y	0.132	0.100	0.079	0.111	Km
Width	8	12	8	12	Meters
# of Lanes	2	3	2	3	#
Capacity	3100	4600	3100	4600	
Speed Limit	45	45	45	45	m.p.h.
Volume	740	1400	740	1430	veh/hr.
Exit Link:					
Beg.X	0.110	0.110	0.071	0.072	Km
Beg.Y	0.124	0.084	0.086	0.128	Km
End X	0.175	0.160	0.022	0.021	Km
End Y	0.202	0.002	0.010	0.212	Km
Width	7	12	7	12	Meters
# of Lanes	2	3	2	3	#
Speed Limit	45	45	45	45	m.p.h.
Volume	960	1590	660	1100	veh/hr.
Receptor Location:					
X			0.084		Km
Y			0.052		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL

Time Period: 11:00 - 19:00

Intersection: Idlewild/Independence (448) X= 0.552 Km;Y= 0.130 Km

Phasing: 7-phase, full actuated

(Link) Parameter	Link N(Indep)	E(Idlwd)	S(Indep)	W(Idwld)	Units
Approach Link:					
Beg.X	0.446	0.655	0.663	0.102	Km
Beg.Y	0.203	0.142	0.055	0.081	Km
End X	0.529	0.579	0.579	0.532	Km
End Y	0.138	0.135	0.123	0.124	Km
Width	11	6	11	6.5	Meters
# of Lanes	3	2	3	2	#
Capacity	6000	2800	4500	2900	veh/hr.(Level E)
Speed Limit	45	35	45	35	m.p.h.
Volume	1520	430	1160	600	veh/hr.
Exit Link:					
Beg.X	0.552	0.587	0.552	0.522	Km
Beg.Y	0.145	0.129	0.119	0.132	Km
End X	0.456	0.655	0.652	0.092	Km
End Y	0.223	0.136	0.038	0.087	Km
Width	11	4	12	4	Meters
# of Lanes	3	1	3	1	#
Speed Limit	45	35	45	35	m.p.h.
Volume	1320	540	1430	430	veh/hr.
Receptor Location:					
X				0.475	Km
Y				0.152	Km
Z				3	Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Eastway/Monroe/Wendover (474); X= 0.124 Km;Y= 0.101 Km

Phasing: 7-phase full actuated

(Link) Parameter	Link N(East.)	E(Mon.)	S(Wend.)	W(Mon.)	Units
Approach Link:					
Beg.X	0.121	0.220	0.115	0.018	Km
Beg.Y	0.204	0.105	0.002	0.097	Km
End X	0.118	0.139	0.127	0.106	Km
End Y	0.115	0.106	0.086	0.096	Km
Width	9	8	7	7	Meters
# of Lanes	2	2	2	2	#
Capacity	3100	3100	3000	3000	
Speed Limit	45	45	35	45	m.p.h.
Volume	840	770	750	910	veh/hr.
Exit Link:					
Beg.X	0.131	0.139	0.117	0.107	Km
Beg.Y	0.115	0.095	0.088	0.107	Km
End X	0.134	0.220	0.105	0.018	Km
End Y	0.204	0.094	0.002	0.106	Km
Width	9	7	6	8	Meters
# of Lanes	2	2	2	2	#
Speed Limit	45	45	35	45	m.p.h.
Volume	940	980	680	670	veh/hr.
Receptor Location:					
X		0.178			Km
Y		0.118			Km
Z		3			Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Central/Kilborne/Norland (458); X= 0.132 Km;Y= 0.090 Km

Phasing: 7-phase full actuated

(Link) Parameter	Link N(Kilb.)	E(Cent.)	S(Norl.)	W(Cent.)	Units
Approach Link:					
Beg.X	0.196	0.260	0.060	0.001	Km
Beg.Y	0.195	0.049	0.001	0.141	Km
End X	0.140	0.147	0.128	0.113	Km
End Y	0.107	0.088	0.076	0.091	Km
Width	3	6	3	6	Meters
# of Lanes	1	2	1	2	#
Capacity	1400	2800	1400	2800	
Speed Limit	35	40	35	40	m.p.h.
Volume	380	860	250	980	veh/hr.
Exit Link:					
Beg.X	0.148	0.140	0.121	0.119	Km
Beg.Y	0.104	0.079	0.079	0.100	Km
End X	0.200	0.264	0.058	0.014	Km
End Y	0.200	0.039	0.007	0.146	Km
Width	4	6	4	6	Meters
# of Lanes	1	2	1	2	#
Speed Limit	35	40	35	40	m.p.h.
Volume	390	1160	180	730	veh/hr.
Receptor Location:					
X				0.084	Km
Y				0.090	Km
Z				3	Meters

DATA FOR MIDBLOCK MODEL

Time Period: 11:00 - 19:00

Intersection: Rama/Sardis Data (494); X= 0.111 Km;Y= 0.090 Km

Phasing: 5-phase full actuated

(Link) Parameter / Approach Link:	Link N(Rama.)	E(Sard.)	S( )	W(Sard.)	Units
Beg.X	0.163	0.190		0.013	Km
Beg.Y	0.198	0.043		0.142	Km
End X	0.112	0.122		0.094	Km
End Y	0.102	0.086		0.094	Km
Width	6	3		3	Meters
# of Lanes	2	1	0	1	#
Capacity	2800	1400	0	1400	
Speed Limit	35	45	0	45	m.p.h.
Volume	380	350	0	780	veh/hr.
Exit Link:					
Beg.X	0.117	0.120	0:105	0.100	Km
Beg.Y	0.099	0.079	0.082	0.100	Km
End X	0.167	0.188	0.066	0.016	Km
End Y	0.194	0.039	0.021	0.148	Km
Width	3	4	7	3	Meters
# of Lanes	1	1	2	1	#
Speed Limit	35	45	25	45	m.p.h.
Volume	450	500	60	520	veh/hr.
Receptor Location:					
X				0.046	Km
Y				0.102	Km
Z				3	Meters

RECEIVED

APR 13 1981

ENGINEERING SCIENCE

DATA FOR MIDBLOCK MODEL Time Period: 10:00 - 18:00

Intersection: Providence/Queens (506) X= 0.120 Km;Y= 0.096 Km

Phasing: 5-phase full actuated

(Link) Parameter	Link N(Prov.)	E(Prov.)	S(Quen.)	W(Quen.)	Units
Approach Link:					
Beg.X	0.149	0.192	0.093	0.045	Km
Beg.Y	0.200	0.000	0.000	0.140	Km
End X	0.117	0.136	0.115	0.099	Km
End Y	0.115	0.084	0.068	0.099	Km
Width	4	6.5	6	6.5	Meters
# of Lanes	1	2	2	2	#
Capacity	1500	2800	2800	2800	
Speed Limit	35	35	35	35	m.p.h.
Volume	810	700	540	630	veh/hr.
Exit Link:					
Beg.X	0.125	0.130	0.100	0.106	Km
Beg.Y	0.108	0.078	0.072	0.111	Km
End X	0.154	0.185	0.075	0.055	Km
End Y	0.200	0.000	0.000	0.150	Km
Width	6.5	7	6.5	6	Meters
# of Lanes	2	2	2	2	#
Speed Limit	35	35	35	35	m.p.h.
Volume	760	850	600	460	veh/hr.
Receptor Location:					
X	0.111				Km
Y	0.149				Km
Z	3				Meters

DATA FOR MIDBLOCK MODEL Time Period: 10:30 - 18:30

Intersection: Providence/Sharon Amity (509) X= 0.115 Km;Y= 0.121 Km

Phasing: 8-phase full actuated

(Link) Parameter	Link N(S.A.)	E(Prov.)	S(Shar.)	W(Prov.)	Units
Approach Link:					
Beg.X	0.250	0.185	0.000	0.044	Km
Beg.Y	0.177	0.000	0.055	0.221	Km
End X	0.127	0.128	0.104	0.103	Km
End Y	0.132	0.111	0.111	0.131	Km
Width	6	7	7	7	Meters
# of Lanes	2	2	2	2	#
Capacity	2800	3000	3000	3000	
Speed Limit	45	45	45	45	m.p.h.
Volume	710	550	650	800	veh/hr.
Exit Link:					
Beg.X	0.131	0.118	0.100	0.113	Km
Beg.Y	0.123	0.106	0.120	0.136	Km
End X	0.250	0.173	0.000	0.048	Km
End Y	0.170	0.000	0.062	0.235	Km
Width	5	7	6	7	Meters
# of Lanes	2	2	2	2	#
Speed Limit	45	45	45	45	m.p.h.
Volume	790	750	580	590	veh/hr.
Receptor Location:					
X		0.155			Km
Y		0.092			Km
Z		3			Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Fairview/Park (657) X= 0.106 Km;Y= 0.114 Km

Phasing: 4-phase full actuated

(Link) Parameter	Link N(Drwy.)	E(Fair.)	S(Park)	W(Park.)	Units
Approach Link:					
Beg.X	0.112	0.222	0.099	0.000	Km
Beg.Y	0.159	0.114	0.000	0.105	Km
End X	0.102	0.120	0.107	0.093	Km
End Y	0.130	0.120	0.101	0.111	Km
Width	7	7	7	7	Meters
# of Lanes	2	2	2	2	#
Capacity	3000	3000	3000	3000	
Speed Limit	25	35	45	35	m.p.h.
Volume	90	1080	620	1320	veh/hr.
Exit Link:					
Beg.X	0.109	0.120	0.100	0.094	Km
Beg.Y	0.129	0.110	0.100	0.122	Km
End X	0.118	0.223	0.095	0.000	Km
End Y	0.157	0.106	0.000	0.116	Km
Width	4	7	3	6	Meters
# of Lanes	1	2	1	2	#
Speed Limit	25	35	45	35	m.p.h.
Volume	60	1340	580	1120	veh/hr.
Receptor Location:					
X				0.056	Km
Y				0.086	Km
Z				3	Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Providence/Wendover (508) X= 0.080 Km;Y= 0.087 Km

Phasing: 5-phase full actuated

(Link) Parameter	Link N(Wend.)	E(Prov.)	S(Wend.)	W(Prov.)	Units
Approach Link:					
Beg.X	0.183	0.188	0.000	0.007	Km
Beg.Y	0.201	0.000	0.009	0.201	Km
End X	0.087	0.094	0.071	0.066	Km
End Y	0.102	0.081	0.074	0.094	Km
Width	7	7	7.5	7	Meters
# of Lanes	2	2	2	2	#
Capacity	3000	3000	3100	3000	
Speed Limit	35	40	35	40	m.p.h.
Volume	530	1040	640	940	veh/hr.
Exit Link:					
Beg.X	0.094	0.085	0.065	0.074	Km
Beg.Y	0.094	0.073	0.083	0.102	Km
End X	0.193	0.171	0.000	0.019	Km
End Y	0.202	0.000	0.025	0.201	Km
Width	7	7	7.5	7	Meters
# of Lanes	2	2	2	2	#
Speed Limit	35	40	35	40	m.p.h.
Volume	640	850	550	1120	veh/hr.
Receptor Location:					
X		0.120			Km
Y		0.077			Km
Z		3			Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Fairview/Providence/Sardis (510) X= 0.109 Km;Y= 0.095 Km

Phasing: 8-phase full actuated

(Link) Parameter	Link N(Prov.)	E(Sard.)	S(Prov.)	W(Fair.)	Units
Approach Link:					
Beg.X	0.006	0.158	0.199	0.070	Km
Beg.Y	0.201	0.201	0.000	0.000	Km
End X	0.087	0.115	0.124	0.103	Km
End Y	0.109	0.116	0.086	0.068	Km
Width	7	7	7	7	Meters
# of Lanes	2	2	2	2	#
Capacity	3000	3000	3000	3000	veh/hr.(Level E)
Speed Limit	45	45	45	45	m.p.h.
Volume	740	680	510	1050	veh/hr.
Exit Link:					
Beg.X	0.094	0.125	0.119	0.094	Km
Beg.Y	0.117	0.109	0.075	0.074	Km
End X	0.013	0.171	0.186	0.057	Km
End Y	0.201	0.201	0.000	0.000	Km
Width	7	7	7	6	Meters
# of Lanes	2	2	2	2	#
Speed Limit	45	45	45	45	m.p.h.
Volume	540	820	840	780	veh/hr.
Receptor Location:					
X				0.148	Km
Y				0.076	Km
Z				3	Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Central/Eastway (457) X= 0.133 Km;Y= 0.117 Km

Phasing: 8-phase full actuated

(Link) Parameter	Link N(Eway.)	E(Cent.)	S(Eway.)	W(Cent.)	Units
Approach Link:					
Beg.X	0.153	0.258	0.113	0.000	Km
Beg.Y	0.247	0.094	0.000	0.146	Km
End X	0.129	0.149	0.136	0.114	Km
End Y	0.134	0.118	0.098	0.115	Km
Width	7	7	8	7	Meters
# of Lanes	2	2	2	2	#
Capacity	3000	3000	3100	3000	
Speed Limit	45	40	45	40	m.p.h.
Volume	950	780	1020	990	veh/hr.
Exit Link:					
Beg.X	0.142	0.148	0.123	0.116	Km
Beg.Y	0.131	0.106	0.102	0.127	Km
End X	0.163	0.256	0.102	0.000	Km
End Y	0.245	0.079	0.000	0.156	Km
Width	7	7	8	7	Meters
# of Lanes	2	2	2	2	#
Speed Limit	45	40	45	40	m.p.h.
Volume	980	980	1000	790	veh/hr.
Receptor Location:					
X				0.074	Km
Y				0.115	Km
Z				3	Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Sugar Creek/Tryon (212) X= 0.109 Km;Y= 0.138 Km

Phasing: 8-phase full actuated

(Link) Parameter	Link N(S. C.)	E(Tryon)	S(S. C.)	W(Tryon)	Units
Approach Link:					
Beg.X	0.091	0.250	0.139	0.012	Km
Beg.Y	0.266	0.158	0.000	0.086	Km
End X	0.101	0.127	0.119	0.086	Km
End Y	0.159	0.150	0.120	0.124	Km
Width	7	7	7	7	Meters
# of Lanes	2	2	2	2	#
Capacity	3000	3000	3000	3000	
Speed Limit	45	45	45	45	m.p.h.
Volume	1060	980	910	1100	veh/hr.
Exit Link:					
Beg.X	0.112	0.130	0.108	0.082	Km
Beg.Y	0.160	0.137	0.118	0.136	Km
End X	0.102	0.250	0.128	0.010	Km
End Y	0.268	0.147	0.000	0.098	Km
Width	7	11	7	7	Meters
# of Lanes	2	3	2	2	#
Speed Limit	45	45	45	45	m.p.h.
Volume	1010	1230	880	930	veh/hr.
Receptor Location:					
X	0.102				Km
Y	0.144				Km
Z	3				Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Orr/Tryon (283); X= 0.124 Km;Y= 0.120 Km

Phasing: Not signalized

(Link) Parameter	Link N(Tryon)	E(Orr)	S(Tryon)	W(=)	Units
Approach Link:					
Beg.X	0.175	0.231	0.058		Km
Beg.Y	0.250	0.057	0.005		Km
End X	0.123	0.136	0.125		Km
End Y	0.129	0.117	0.114		Km
Width	7	4	7		Meters
# of Lanes	2	1	2		#
Capacity	3000	1500	3000		
Speed Limit	45	35	45		m.p.h.
Volume	880	90	950		veh/hr.
Exit Link:					
Beg.X	0.131	0.134	0.117		Km
Beg.Y	0.125	0.113	0.118		Km
End X	0.180	0.226	0.048		Km
End Y	0.241	0.055	0.002		Km
Width	7	4	7		Meters
# of Lanes	2	1	2		#
Speed Limit	45	35	45		m.p.h.
Volume	990	110	880		veh/hr.
Receptor Location:					
X		0.172			Km
Y		0.100			Km
Z		3			Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Idlewild North/Lawyers (553); X= 0.137 Km;Y= 0.102 Km

Phasing: Not signalized

(Link) Parameter	Link N(=)	E(Lawy.)	S(Idle.)	W(Lawy.)	Units
Approach Link:					
Beg.X		0.234	0.082	0.002	Km
Beg.Y		0.045	0.009	0.192	Km
End X		0.146	0.138	0.126	Km
End		0.101	0.093	0.104	Km
Width		5	4	5	Meters
# of Lanes		1	1	1	#
Capacity		1600	1500	1600	
Speed Limit		45	45	45	m.p.h.
Volume		410	90	560	veh/hr.
Exit Link:					
Beg.X		0.142	0.133	0.130	Km
Beg.Y		0.095	0.095	0.109	Km
End X		0.233	0.076	0.009	Km
End Y		0.043	0.007	0.200	Km
Width		5	4	5	Meters
# of Lanes		1	1	1	#
Speed Limit		45	45	45	m.p.h.
Volume		590	100	380	veh/hr.
Receptor Location:					
X				0.137	Km
Y				0.065	Km
Z				3	Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Archdale/South Blvd.(628); X= 0.264 Km;Y= 0.103 Km

Phasing: 6-phase full actuated

(Link) Parameter	Link N(South)	E(Arch.)	S(South)	W(Arch.)	Units
Approach Link:					
Beg.X	0.252	0.400	0.275	0.132	Km
Beg.Y	0.276	0.116	0.000	0.114	Km
End X	0.258	0.278	0.271	0.250	Km
End Y	0.115	0.111	0.090	0.098	Km
Width	7	4	7.5	3.5	Meters
# of Lanes	2	1	2	1	#
Capacity	3000	1500	3000	1500	veh/hr.(Level E)
Speed Limit	45	35	45	35	m.p.h.
Volume	780	350	780	430	veh/hr.
Exit Link:					
Beg.X	0.269	0.280	0.259	0.250	Km
Beg.Y	0.116	0.098	0.090	0.105	Km
End X	0.263	0.400	0.266	0.134	Km
End Y	0.236	0.103	0.000	0.121	Km
Width	7	6	7	5	Meters
# of Lanes	2	1	2	1	#
Speed Limit	45	35	45	35	m.p.h.
Volume	780	420	760	380	veh/hr.
Receptor Location:					
X				0.214	Km
Y				0.085	Km
Z				3	Meters

ATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Archdale/Old Pineville (629) S. Blvd. X= 0.123 Km;Y= 0.118 Km

Phasing: 2-phase, full actuated

(Link) Parameter	Link N(O.P.)	E(Arch.)	S(O.P.)	W(Arch.)	Units
Approach Link:					
Beg.X	0.133	0.250	0.109	0.000	Km
Beg.Y	0.250	0.105	0.000	0.126	Km
End X	0.120	0.134	0.125	0.112	Km
End Y	0.130	0.121	0.106	0.113	Km
Width	3.5	3.5	4.5	3	Meters
# of Lanes	1	1	1	1	#
Capacity	1500	1500	1600	1400	veh/hr.(Level E)
Speed Limit	45	35	45	35	m.p.h.
Volume	350	370	260	370	veh/hr.
Exit Link:					
Beg.X	0.128	0.132	0.116	0.112	Km
Beg.Y	0.130	0.114	0.106	0.125	Km
End X	0.144	0.250	0.103	0.000	Km
End Y	0.250	0.098	0.000	0.132	Km
Width	5	4	4	5	Meters
# of Lanes	1	1	1	1	#
Speed Limit	45	35	45	35	m.p.h.
Volume	280	430	280	350	veh/hr.
Receptor Location:					
X					Km
Y					Km
Z					Meters

DATA FOR MIDBLOCK MODEL Time Period: 10:30 - 18:30

Intersection: South Blvd./Tyvola (625); X= 0.273 Km;Y= 0.091 Km

Phasing: 8-phase full actuated

(Link) Parameter	Link N(S.Blv)	E(Tyvl.)	S(S.Blv)	W(Tyvl.)	Units
Approach Link:					
Beg.X	0.256	0.387	0.287	0.138	Km
Beg.Y	0.226	0.065	0.000	0.115	Km
End X	0.266	0.287	0.281	0.256	Km
End Y	0.107	0.092	0.072	0.088	Km
Width	7	7	7	7	Meters
# of Lanes	2	2	2	2	#
Capacity	3000	3000	3000	3000	veh/hr.(Level E)
Speed Limit	45	35	45	45	m.p.h.
Volume	880	690	860	800	veh/hr.
Exit Link:					
Beg.X	0.277	0.288	0.269	0.257	Km
Beg.Y	0.109	0.078	0.072	0.101	Km
End X	0.263	0.380	0.277	0.136	Km
End Y	0.226	0.055	0.000	0.129	Km
Width	7	7	7	7	Meters
# of Lanes	2	2	2	2	#
Speed Limit	45	35	45	45	m.p.h.
Volume	800	670	980	810	veh/hr.
Receptor Location:					
X				0.221	Km
Y				0.078	Km
Z				3	Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Old Pineville/Tyvola (626); X= 0.123 Km;Y= 0.128 Km

Phasing: 2-phase full actuated

(Link) Parameter	Link N(O.P.)	E(Tyvl.)	S(O.P.)	W(Tyvl.)	Units
Approach Link:					
Beg.X	0.098	0.257	0.144	0.000	Km
Beg.Y	0.250	0.101	0.000	0.126	Km
End X	0.117	0.136	0.134	0.114	Km
End Y	0.143	0.129	0.106	0.120	Km
Width	4	7	4	7	Meters
# of Lanes	1	2	1	2	#
Capacity	1500	3000	1500	3000	veh/hr.(Level E)
Speed Limit	40	45	40	45	m.p.h.
Volume	340	770	330	860	veh/hr.
Exit Link:					
Beg.X	0.125	0.138	0.125	0.109	Km
Beg.Y	0.144	0.115	0.104	0.134	Km
End X	0.103	0.256	0.140	0.000	Km
End Y	0.250	0.088	0.000	0.138	Km
Width	4	7	5	7	Meters
# of Lanes	1	2	1	2	#
Speed Limit	40	45	40	45	m.p.h.
Volume	260	840	350	840	veh/hr.
Receptor Location:					
X		0.221			Km
Y		0.078			Km
Z		3			Meters

DATA FOR MIDBLOCK MODEL Time Period: 10:00 - 18:00

Intersection: Graham/I-85 S.Ramp(262); X= 0.092 Km;Y= 0.116 Km

Phasing: 3-phase-full actuated

(Link) Parameter	Link N(Grah.)	E(I-85)	S(Grah.)	W( )	Units
Approach Link:					
Beg.X	0.232	0.187	0.002		Km
Beg.Y	0.321	0.097	0.000		Km
End X	0.091	0.098	0.071		Km
End Y	0.129	0.114	0.096		Km
Width	6	6.5	3		Meters
# of Lanes	2	2	1		#
Capacity	2800	2900	1400		veh/hr.(Level E)
Speed Limit	45	35	45		m.p.h.
Volume	360	330	590		veh/hr.
Exit Link:					
Beg.X	0.096	0.096	0.068		Km
Beg.Y	0.126	0.107	0.099		Km
End X	0.236	0.187	0.000		Km
End Y	0.319	0.091	0.008		Km
Width	3	3.5	6.5		Meters
# of Lanes	1	1	2		#
Speed Limit	45	35	45		m.p.h.
Volume	580	200	420		veh/hr.
Receptor Location:					
X			0.076		Km
Y			0.075		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL Time Period: 10:00 - 18:00

Intersection: Graham/I-85 N.Ramp(263); X= 0.243 Km;Y= 0.331 Km

Phasing: 3-phase-full actuated

(Link) Parameter	Link N(Grah.)	E(I-85)	S(Grah.)	W( )	Units
Approach Link:					
Beg.X	0.304	0.322	0.096		Km
Beg.Y	0.422	0.298	0.126		Km
End X	0.247	0.257	0.236		Km
End Y	0.345	0.332	0.319		Km
Width	3	4	3		Meters
# of Lanes	1	1	1		#
Capacity	1400	1500	1400		veh/hr.(Level E)
Speed Limit	45	35	45		m.p.h.
Volume	240	110	460		veh/hr.
Exit Link:					
Beg.X	0.252	0.249	0.232		Km
Beg.Y	0.341	0.319	0.321		Km
End X	0.306	0.325	0.091		Km
End Y	0.411	0.294	0.129		Km
Width	6	4	6		Meters
# of Lanes	2	1	2		#
Speed Limit	45	35	45		m.p.h.
Volume	300	180	270		veh/hr.
Receptor Location:					
X					Km
Y					Km
Z					Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: LaSalle/I-77/E.Ramp (900) X= 0.245 Km;Y= 0.142 Km

Phasing: Not signalized

(Link) Parameter	Link N(E.Rmp)	E(LaSal)	S(E.Rmp)	W(LaSal)	Units
Approach Link:					
Beg.X	0.206	0.383	0.214	0.078	Km
Beg.Y	0.238	0.139	0.033	0.138	Km
End X	0.250	0.244	0.251	0.227	Km
End Y	0.153	0.148	0.127	0.136	Km
Width	0	8	4	7.5	Meters
# of Lanes	0	2	2	2	#
Capacity	0	3100		3000	veh/hr.(Level E)
Speed Limit	0	35	35	35	m.p.h.
Volume	0	400	340	280	veh/hr.
Exit Link:					
Beg.X	0.250	0.245	0.251	0.228	Km
Beg.Y	0.153	0.136	0.127	0.149	Km
End X	0.206	0.383	0.214	0.074	Km
End Y	0.238	0.132	0.033	0.150	Km
Width	6	7.5	4	8	Meters
# of Lanes	1	2	0	2	#
Speed Limit	35	35	0	35	m.p.h.
Volume	70	390	0	560	veh/hr.
Receptor Location:					
X			0.254		Km
Y			0.100		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: LaSalle/I-77/W.Ramp (901) X= 0.064 Km;Y= 0.143 Km

Phasing: Not signalized

(Link) Parameter	Link N(W.Rmp)	E(LaSal)	S(W.Rmp)	W(LaSal)	Units
Approach Link:					
Beg.X	0.065	0.228	0.085	0.000	Km
Beg.Y	0.235	0.149	0.000	0.145	Km
End X	0.067	0.074	0.069	0.053	Km
End Y	0.161	0.150	0.122	0.139	Km
Width	7	7	5	7	Meters
# of Lanes	2	2	0	2	#
Capacity	3000	3000	0	3000	veh/hr.(Level E)
Speed Limit	35	35	0	35	m.p.h.
Volume	60	500	0	320	veh/hr.
Exit Link:					
Beg.X	0.067	0.078	0.069	0.049	Km
Beg.Y	0.161	0.138	0.122	0.150	Km
End X	0.065	0.227	0.085	0.000	Km
End Y	0.235	0.136	0.000	0.153	Km
Width	7	7	5	6	Meters
# of Lanes	0	2	1	2	#
Speed Limit	0	35	35	35	m.p.h.
Volume	0	240	250	390	veh/hr.
Receptor Location:					
X				0.254	Km
Y				0.100	Km
Z				3	Meters

DATA FOR MIDBLOCK MODEL Time Period: 10:00 - 16:00

Intersection: Independence/Seventh (414); X= 0.103 Km;Y= 0.100 Km

Phasing: 2-phase - fixed time (cycle = 90s; Indep.-65, Seventh-25)

(Link) Parameter / Approach Link:	Link N(Ind.)	E(7th)	S(Ind.)	W(7th)	Units
Beg.X	0.125	0.198	0.088	0.002	Km
Beg.Y	0.206	0.076	0.007	0.126	Km
End X	0.100	0.121	0.105	0.086	Km
End Y	0.115	0.098	0.087	0.102	Km
Width	13	5	7	5	Meters
# of Lanes	3	2	2	2	#
Capacity	4600	1800	3000	1800	veh/hr.(Level E)
Speed Limit	35	35	35	35	m.p.h.
Volume	740	340	980	260	veh/hr.
Exit Link:					
Beg.X	0.115	0.120	0.094	0.089	Km
Beg.Y	0.111	0.093	0.090	0.107	Km
End X	0.198	0.197	0.076	0.004	Km
End Y	0.185	0.071	0.011	0.131	Km
Width	8	5	10	5	Meters
# of Lanes	2	2	3	2	#
Speed Limit	35	35	35	35	m.p.h.
Volume	860	300	880	290	veh/hr.
Receptor Location:					
X			0.116		Km
Y			0.065		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL Time Period: 16:00 - 16:30

Intersection: Independence/Seventh (414); X= 0.103 Km;Y= 0.100 Km

Phasing: 2-phase - fixed time (cycle=100s; Indep.-50, Seventh-50)

(Link) Parameter	Link N(Ind.)	E(7th)	S(Ind.)	W(7th)	Units
Approach Link:					
Beg.X	0.125	0.198	0.088	0.002	Km
Beg.Y	0.206	0.076	0.007	0.126	Km
End X	0.100	0.121	0.105	0.086	Km
End Y	0.115	0.098	0.087	0.102	Km
Width	13	5	7	5	Meters
# of Lanes	3	2	2	2	#
Capacity	4600	1800	3000	1800	Veh/hr, (Level E)
Speed Limit	35	35	35	35	m.p.h.
Volume	590	370	1240	340	veh/hr.
Exit Link:					
Beg.X	0.115	0.120	0.094	0.089	Km
Beg.Y	0.111	0.093	0.090	0.107	Km
End X	0.198	0.197	0.076	0.004	Km
End Y	0.185	0.071	0.011	0.131	Km
Width	8	5	10	5	Meters
# of Lanes	2	2	3	2	#
Speed Limit	35	35	35	35	m.p.h.
Volume	1040	430	720	360	veh/hr.
Receptor Location:					
X			0.116		Km
Y			0.065		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL Time Period: 16:30 - 17:00

Intersection: Independence/Seventh (414); X= 0.103 Km;Y= 0.100 Km

Phasing: 2-phase - fixed time (cycle = 105s.; Indep.-53, Seventh-52)

(Link) Parameter	Link N(Ind.)	E(7th)	S(Ind.)	W(7th)	Units
Approach Link:					
Beg.X	0.125	0.198	0.088	0.002	Km
Beg.Y	0.206	0.076	0.007	0.126	Km
End X	0.100	0.121	0.105	0.086	Km
End Y	0.115	0.098	0.087	0.102	Km
Width	13	5	7	5	Meters
# of Lanes	3	2	2	2	#
Capacity	4600	1800	3000	1800	Veh/hr.(Level E)
Speed Limit	35	35	35	35	m.p.h.
Volume	630	320	1790	480	veh/hr.
Exit Link:					
Beg.X	0.115	0.120	0.094	0.089	Km
Beg.Y	0.111	0.093	0.090	0.107	Km
End X	0.198	0.197	0.076	0.004	Km
End Y	0.185	0.071	0.011	0.131	Km
Width	8	5	10	5	Meters
# of Lanes	2	2	3	2	#
Speed Limit	35	35	35	35	m.p.h.
Volume	1540	620	720	330	veh/hr.
Receptor Location:					
X			0.116		Km
Y			0.065		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL Time Period: 17:00 - 17:30

Intersection: Independence/Seventh (414); X= 0.103 Km;Y= 0.100 Km

Phasing: 2-phase - fixed time (cycle=145, Indep.-73, Seventh-72)

(Link) Parameter	Link N(Ind.)	E(7th)	S(Ind.)	W(7th)	Units
Approach Link:					
Beg.X	0.125	0.198	0.088	0.002	Km
Beg.Y	0.206	0.076	0.007	0.126	Km
End X	0.100	0.121	0.105	0.086	Km
End Y	0.115	0.098	0.087	0.102	Km
Width	13	5	7	5	Meters
# of Lanes	3	2	2	2	#
Capacity	4600	1800	3000	1800	Veh/hr.(Level E)
Speed Limit	35	35	35	35	m.p.h.
Volume	510	330	2220	970	veh/hr.
Exit Link:					
Beg.X	0.115	0.120	0.094	0.089	Km
Beg.Y	0.111	0.093	0.090	0.107	Km
End X	0.198	0.197	0.076	0.004	Km
End Y	0.185	0.071	0.011	0.131	Km
Width	8	5	10	5	Meters
# of Lanes	2	2	3	2	#
Speed Limit	35	35	35	35	m.p.h.
Volume	2050	1030	570	380	veh/hr.
Receptor Location:					
X			0.116		Km
Y			0.065		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL Time Period: 17:30 - 18:00

Intersection: Independence/Seventh (414); X= 0.103 Km;Y= 0.100 Km

Phasing: 2-phase - fixed time (cycle -100; Indep.-50, Seventh-50)

(Link) Parameter	Link N(Ind.)	E(7th)	S(Ind.)	W(7th)	Units
Approach Link:					
Beg.X	0.125	0.198	0.088	0.002	Km
Beg.Y	0.206	0.076	0.007	0.126	Km
End X	0.100	0.121	0.105	0.086	Km
End Y	0.115	0.098	0.087	0.102	Km
Width	13	5	7	5	Meters
# of Lanes	3	2	2	2	#
Capacity	4600	1800	3000	1800	Veh/hr.(Level E)
Speed Limit	35	35	35	35	m.p.h.
Volume	600	310	1680	820	veh/hr.
Exit Link:					
Beg.X	0.115	0.120	0.094	0.089	Km
Beg.Y	0.111	0.093	0.090	0.107	Km
End X	0.198	0.197	0.076	0.004	Km
End Y	0.185	0.071	0.011	0.131	Km
Width	8	5	10	5	Meters
# of Lanes	2	2	3	2	#
Speed Limit	35	35	35	35	m.p.h.
Volume	1530	900	710	260	veh/hr.
Receptor Location:					
X			0.116		Km
Y			0.065		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Brookshire/I-85 E.Ramp (875) X= 0.235 Km;Y= 0.086 Km

Phasing: 4-phase full actuated

(Link) Parameter	Link N(E.Rmp)	E(Brksh)	S(E.Rmp)	W(Brksh)	Units
Approach Link:					
Beg.X	0.239	0.370	0.196	0.137	Km
Beg.Y	0.213	0.058	0.020	0.110	Km
End X	0.241	0.246	0.231	0.216	Km
End Y	0.112	0.091	0.075	0.087	Km
Width	6	7	7.5	7	Meters
# of Lanes		2	2	2	#
Capacity		3000	3000	3000	veh/hr.(Level E)
Speed Limit		45	35	45	m.p.h.
Volume		970	610	830	veh/hr.
Exit Link:					
Beg.X	0.241	0.246	0.231	0.225	Km
Beg.Y	0.112	0.081	0.075	0.096	Km
End X	0.239	0.360	0.196	0.141	Km
End Y	0.213	0.051	0.020	0.119	Km
Width	6	10	7.5	7	Meters
# of Lanes	1	3		2	#
Speed Limit	35	45		45	m.p.h.
Volume	200	1030	0	1100	veh/hr.
Receptor Location:					
X			0.070		Km
Y			0.107		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Brookshire/I-85 W.Ramp (899) X= 0.122 Km;Y= 0.120 Km

Phasing: 4-phase full actuated

(Link) Parameter	Link N(W.Rmp)	E(Brksh)	S(W.Rmp)	W(Brksh)	Units
Approach Link:					
Beg.X	0.184	0.225	0.120	0.000	Km
Beg.Y	0.215	0.096	0.000	0.152	Km
End X	0.126	0.141	0.119	0.103	Km
End Y	0.132	0.119	0.105	0.118	Km
Width	7.5	7	5.5	7.5	Meters
# of Lanes	2	2	o	2	#
Capacity	3000	3000	o	3000	veh/hr.(Level E)
Speed Limit	35	45	o	45	m.p.h.
Volume	260	1030	0	820	veh/hr.
Exit Link:					
Beg.X	0.126	0.137	0,119	0.109	Km
Beg.Y	0.132	0.110	0.105	0.129	Km
End X	0.184	0.216	0.120	0.000	Km
End Y	0.215	0.087	0.000	0.164	Km
Width	7.5	7	5.5	7	Meters
# of Lanes		2	1	2	#
Speed Limit		45	35	45	m.p.h.
Volume		760	450	970	veh/hr.
Receptor Location:					
X				0.070	Km
Y				0.107	Km
Z				3	Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Sugar Creek/I-85 N.Ramp (229) X= 0.131 Km;Y= 0.287 Km

Phasing: 3-phase coordinated

(Link) Parameter	Link N(S. C.)	E(I-85)	S(S. C.)	W(I-85)	Units
Approach Link:					
Beg.X	0.126	0.250	0.132	0.034	Km
Beg.Y	0.418	0.287	0.150	0.236	Km
End X	0.121	0.143	0.135	0.109	Km
End Y	0.298	0.294	0.278	0.283	Km
Width	7	3.5	7	6.5	Meters
# of Lanes	2	1	2	0	#
Capacity	3000	1500	300(	0	veh/hr.(Level E)
Speed Limit	45	35	4:	0	m.p.h.
Volume	410	100	78	0	veh/hr.
Exit Link:					
Beg.X	0.136	0.143	0.120	0.109	Km
Beg.Y	0.299	0.294	0.264	0.283	Km
End X	0.138	0.250	0.117	0.034	Km
End Y	0.419	0.287	0.143	0.236	Km
Width	7	3.5	7.5	6.5	Meters
# of Lanes	2	0	2	1	#
Speed Limit	45	0	45	35	m.p.h.
Volume	420	0	430	490	veh/hr.
Receptor Location:					
X	0.100				Km
Y	0.350				Km
Z	3				Meters

DATA FOR MIDBLOCK MODEL Time Period: 10:30 - 18:30

Intersection: Sugar Creek/I-85 S.Ramp (228) X= 0.125 Km;Y= 0.134 Km

Phasing: 3-phase coordinated

(Link) Parameter	Link N(S. C.)	E(I-85)	S(S. C.)	W(I-85)	Units
Approach Link:					
Beg.X	0.120	0.206	0.117	0.000	Km
Beg.Y	0.264	0.190	0.000	0.142	Km
End X	0.117	0.142	0.131	0.110	Km
End Y	0.143	0.141	0.122	0.132	Km
Width	7.5	4.5	11	6.5	Meters
# of Lanes	2	0	3	2	#
Capacity	3000	0	4500	2900	veh/hr.(Level E)
Speed Limit	45	0	45	35	m.p.h.
Volume	560	0	910	670	veh/hr.
Exit Link:					
Beg.X	0.132	0.142	0.117	0.110	Km
Beg.Y	0.150	0.141	0.122	0.132	Km
End X	0.135	0.206	0.120	0.000	Km
End Y	0.278	0.190	0.000	0.142	Km
Width	7	4.5	7	6.5	Meters
# of Lanes	2	1	2	0	#
Speed Limit	45	35	45	0	m.p.h.
Volume	900	150	1110	0	veh/hr.
Receptor Location:					
X	0.100				Km
Y	0.350				Km
Z	3				Meters

DATA FOR MIDBLOCK MODEL Time Period: 10:00 - 16:00

Intersection: Hawthorne/Independence (421); X= 0.099 Km;Y= 0.115 Km

Phasing: 2-phase - fixed time (cycle= 90s.; Indep.-62, Hawthorne-28)

(Link) Parameter	Link N(Haw.)	E(Indep)	S(Haw.)	W(Indep)	Units
Approach Link:					
Beg.X	0.134	0.193	0.032	0.006	Km
Beg.Y	0.212	0.074	0.038	0.154	Km
End X	0.100	0.112	0.097	0.085	Km
End Y	0.129	0.111	0.099	0.115	Km
Width	7	10	10	9	Meters
# of Lanes	2	3	3	3	#
Capacity	3000	4400	4400	4200	veh./hr.(Level E)
Speed Limit	35	35	35	35	m.p.h.
Volume	350	1540	540	1740	veh/hr.
Exit Link:					
Beg.X	0.106	0.107	0.089	0.106	Km
Beg.Y	0.126	0.103	0.102	0.124	Km
End X	0.139	0.187	0.024	0.007	Km
End Y	0.208	0.064	0.038	0.164	Km
Width	6	10	6	10	Meters
# of Lanes	2	3	2	3	#
Speed Limit	35	35	35	35	m.p.h.
Volume	480	1670	450	1560	veh/hr.
Receptor Location:					
X		0.146			Km
Y		0.116			Km
Z		3			Meters

DATA FOR MIDBLOCK MODEL Time Period: 16:00 - 16:30

Intersection: Hawthorne/Independence (421); X= 0.099 Km;Y= 0.115 Km

Phasing: 2-phase - fixed time (CYCLE = 100s.; Indep.-78, Hawthorne-22)

(Link) Parameter	Link N(Haw.)	E(Indep)	S(Haw.)	W(Indep)	Units
Approach Link:					
Beg.X	0.134	0.193	0.032	0.006	Km
Beg.Y	0.212	0.074	0.038	0.154	Km
End X	0.100	0.112	0.097	0.085	Km
End Y	0.129	0.111	0.099	0.115	Km
Width	7	10	10	9	Meters
# of Lanes	2	3	3	3	#
Capacity	3000	4400	4400	4200	veh/hr.(Level E)
Speed Limit	35	35	35	35	m.p.h.
Volume	400	1770	710	2700	veh/hr.
Exit Link:					
Beg.X	0.106	0.107	0.089	0.106	Km
Beg.Y	0.126	0.103	0.102	0.124	Km
End X	0.139	0.187	0.024	0.007	Km
End Y	0.208	0.064	0.038	0.164	Km
Width	6	10	6	10	Meters
# of Lanes	2	3	2	3	#
Speed Limit	35	35	35	35	m.p.h.
Volume	640	2660	450	1830	veh/hr.
Receptor Location:					
X		0.146			Km
Y		0.116			Km
Z		3			Meters

DATA FOR MIDBLOCK MODEL Time Period: 16:30 - 17:00

Intersection: Hawthorne/Independence (421); X= 0.099 Km;Y= 0.115 Km

Phasing: 2-phase - fixed time (cycle=105s.; Indep.-82, Hawthorne-23)

(Link) Parameter	Link N(Haw.)	E(Indep)	S(Haw.)	W(Indep)	Units
Approach Link:					
Beg.X	0.134	0.193	0.032	0.006	Km
Beg.Y	0.212	0.074	0.038	0.154	Km
End X	0.100	0.112	0.097	0.085	Km
End Y	0.129	0.111	0.099	0.115	Km
Width	7	10	10	9	Meters
# of Lanes	2	3	3	3	#
Capacity	3000	4400	4400	4200	Veh/hr.(Level E)
Speed Limit	35	35	35	35	m.p.h.
Volume	430	2140	780	3210	veh/hr.
Exit Link:					
Beg.X	0.106	0.107	0.089	0.106	Km
Beg.Y	0.126	0.103	0.102	0.124	Km
End X	0.139	0.187	0.024	0.007	Km
End Y	0.208	0.064	0.038	0.164	Km
Width	6	10	6	10	Meters
# of Lanes	2	3	2	3	#
Speed Limit	35	35	35	35	m.p.h.
Volume	680	3220	500	2160	veh/hr.
Receptor Location:					
X		0.146			Km
Y		0.116			Km
Z		3			Meters

DATA FOR MIDBLOCK MODEL Time Period: 17:00 - 17:30

Intersection: Hawthorne/Independence (421); X= 0.099 Km;Y= 0.115 Km

Phasing: 2-phase - fixed time (cycle=145; Indep.-118, Hawthorne-27)

(Link) Parameter	Link N(Haw.)	E(Indep)	S(Haw.)	W(Indep)	Units
Approach Link:					
Beg.X	0.134	0.193	0.032	0.006	Km
Beg.Y	0.212	0.074	0.038	0.154	Km
End X	0.100	0.112	0.097	0.085	Km
End Y	0.129	0.111	0.099	0.115	Km
Width	7	10	10	9	Meters
# of Lanes	2	3	3	3	#
Capacity	3000	4400	4400	4200	Veh./hr.(Level E)
Speed Limit	35	35	35	35	m.p.h.
Volume	430	1510	820	3160	veh/hr.
Exit Link:					
Beg.X	0.106	0.107	0.089	0.106	Km
Beg.Y	0.126	0.103	0.102	0.124	Km
End X	0.139	0.187	0.024	0.007	Km
End Y	0.208	0.064	0.038	0.164	Km
Width	6	10	6	10	Meters
# of Lanes	2	3	2	3	#
Speed Limit	35	35	35	35	m.p.h.
Volume	660	3260	440	1550	veh/hr.
Receptor Location:					
X		0.146			Km
Y		0.116			Km
Z		3			Meters

DATA FOR MIDBLOCK MODEL Time Period: 17:30 - 18:00

Intersection: Hawthorne/Independence (421); X= 0.099 Km;Y= 0.115 Km

Phasing: 2-phase - fixed time (cycle=100s.; Indep.-78, Hawthorne-22)

(Link) Parameter	Link N(Haw.)	E(Indep)	S(Haw.)	W(Indep)	Units
Approach Link:					
Beg.X	0.134	0.193	0.032	0.006	Km
Beg.Y	0.212	0.074	0.038	0.154	Km
End X	0.100	0.112	0.097	0.085	Km
End Y	0.129	0.111	0.099	0.115	Km
Width	7	10	10	9	Meters
# of Lanes	2	3	3	3	#
Capacity	3000	4400	4400	4200	veh./hr.(Level E)
Speed Limit	35	35	35	35	m.p.h.
Volume	310	1430	670	2620	veh/hr.
Exit Link:					
Beg.X	0.106	0.107	0.089	0.106	Km
Beg.Y	0.126	0.103	0.102	0.124	Km
End X	0.139	0.187	0.024	0.007	Km
End Y	0.208	0.064	0.038	0.164	Km
Width	6	10	6	10	Meters
# of Lanes	2	3	2	3	#
Speed Limit	35	35	35	35	m.p.h.
Volume	570	2660	360	1420	veh/hr.
Receptor Location:					
X		0.146			Km
Y		0.116			Km
Z		3			Meters

DATA FOR MIDBLOCK MODEL Time Period: 10:00 - 16:00

Intersection: Central/Hawthorne (422); X= 0.114 Km;Y= 0.124 Km

Phasing: 2-phase fixed time (cycle = 65s.; Cent.-40, Hawthorne -25)

(Link) Parameter	Link N(Hawth)	E(Cent.)	S(Hawth)	W(Cent.)	Units
Approach Link:					
Beg.X	0.135	0.238	0.098	0.000	Km
Beg.Y	0.250	0.096	0.000	0.149	Km
End X	0.113	0.125	0.118	0.105	Km
End Y	0.135	0.124	0.111	0.123	Km
Width	5	6	6	6	Meters
# of Lanes	2	2	2	2	#
Capacity	1800	2800	2800	2800	veh/hr.(Level E)
Speed Limit	35	35	35	35	m.p.h.
Volume	280	600	270	660	veh/hr.
Exit Link:					
Beg.X	0.117	0.123	0.111	0.105	Km
Beg.Y	0.134	0.118	0.112	0.128	Km
End X	0.140	0.232	0.091	0.000	Km
End Y	0.250	0.092	0.000	0.155	Km
Width	5	5.5	6	5.5	Meters
# of Lanes	1	2	2	2	#
Speed Limit	35	35	35	35	m.p.h.
Volume	270	610	310	620	veh/hr.
Receptor Location:					
X				0.082	Km
Y				0.117	Km
Z				3	Meters

DATA FOR MIDBLOCK MODEL Time Period: 16:00 - 18:00

Intersection: Central/Hawthorne (422); X= 0.114 Km;Y= 0.124 Km

Phasing: 3-phase fixed time (cycle= 100s.; Cent.-65, Hawthorne-35

(Link) Parameter	Link N(Hawth)	E(Cent.)	S(Hawth)	W(Cent.)	Units
Approach Link:					
Beg.X	0.135	0.238	0.098	0.000	Km
Beg.Y	0.250	0.096	0.000	0.149	Km
End X	0.113	0.125	0.118	0.105	Km
End Y	0.135	0.124	0.111	0.123	Km
Width	5	6	6	6	Meters
# of Lanes	2	2	2	2	#
Capacity	1800	2800	2800	2800	veh/hr.(Level E)
Speed Limit	35	35	35	35	m.p.h.
Volume	280	490	440	1240	veh/hr.
Exit Link:					
Beg.X	0.117	0.123	0.111	0.105	Km
Beg.Y	0.134	0.118	0.112	0.128	Km
End X	0.140	0.232	0.091	0.000	Km
End Y	0.250	0.092	0.000	0.155	Km
Width	5	5.5	6	5.5	Meters
# of Lanes	1	2	2	2	#
Speed Limit	35	35	35	35	m.p.h.
Volume	480	1150	290	530	veh/hr.
Receptor Location:					
X				0.082	Km
Y				0.117	Km
Z				3	Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Freedom/Ashley (852) X= 0.247 Km;Y= 0.102 Km

Phasing: 4-phase full actuated

(Link) Parameter	Link N(Free.)	E(Ash.)	S(Free.)	W(Ash.)	Units
Approach Link:					
Beg.X	0.130	0.301	0.350	0.161	Km
Beg.Y	0.203	0.200	0.016	0.000	Km
End X	0.232	0.254	0.261	0.240	Km
End Y	0.106	0.118	0.097	0.082	Km
Width	10.5	4	11	7.5	Meters
# of Lanes	3	1	3	2	#
Capacity	4700	1500	4500	3000	veh/hr.(Level E)
Speed Limit	45	35	45	35	m.p.h.
Volume	820	250	980	500	veh/hr.
Exit Link:					
Beg.X	0.240	0.261	0.252	0.231	Km
Beg.Y	0.116	0.113	0.086	0.091	Km
End X	0.144	0.309	0.350	0.144	Km
End Y	0.209	0.200	0.000	0.000	Km
Width	10.5	3.5	11	7.5	Meters
# of Lanes	3	1	3	2	#
Speed Limit	45	35	45	35	m.p.h.
Volume	870	240	760	690	veh/hr.
Receptor Location:					
X				0.234	Km
Y				0.022	Km
Z				3	Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Freedom/Tuckaseegee (853) X= 0.118 Km;Y= 0.223 Km

Phasing: 5-phase full actuated

(Link) Parameter	Link N(Free.)	E(Tuck.)	S(Free.)	W(Tuck.)	Units
Approach Link:					
Beg.X	0.018	0.212	0.240	0.007	Km
Beg.Y	0.335	0.229	0.116	0.200	Km
End X	0.100	0.144	0.144	0.101	Km
End Y	0.238	0.229	0.209	0.218	Km
Width	9	7	10.5	7.5	Meters
# of Lanes	2	2	3	2	#
Capacity	3100	3000	4700	3000	veh/hr.(Level E)
Speed Limit	45	35	45	45	m.p.h.
Volume	820	240	920	350	veh/hr.
Exit Link:					
Beg.X	0.109	0.150	0.130	0.097	Km
Beg.Y	0.248	0.220	0.203	0.229	Km
End X	0.019	0.211	0.232	0.007	Km
End Y	0.349	0.222	0.106	0.209	Km
Width	12	5.5	10.5	7	Meters
# of Lanes	3	1	3	2	#
Speed Limit	45	35	45	45	m.p.h.
Volume	1020	170	920	220	veh/hr.
Receptor Location:					
X			0.234		Km
Y			0.022		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL Time Period: 11:00 - 19:00

Intersection: Idlewild Rama/Monroe Rd. (480); X= 0.078 Km;Y= 0.078 Km

Phasing: 6-phase, full actuated

(Link) Parameter	Link N(Monroe)	E(Idwld)	S(Monore)	W(Rama)	Units
Approach Link:					
Beg.X	0.000	0.522	0.084	0.025	Km
Beg.Y	0.109	0.132	0.032	0.000	Km
End X	0.047	0.092	0.099	0.062	Km
End Y	0.086	0.087	0.073	0.067	Km
Width	7	6	6	4	Meters
# of Lanes	2	2	2	1	#
Capacity	3000	2800	2800	1500	veh/hr.(Level E)
Speed Limit	45	35	45	35	m.p.h.
Volume	790	480	460	410	veh/hr.
Exit Link:					
Beg.X	0.052	0.102	0.095	0.056	Km
Beg.Y	0.097	0.081	0.065	0.070	Km
End X	0.000	0.532	0.082	0.021	Km
End Y	0.118	0.124	0.028	0.000	Km
Width	6	6.5	6	3	Meters
# of Lanes	2	2	2	1	#
Speed Limit	45	35	45	35	m.p.h.
Volume	630	560	500	430	veh/hr.
Receptor Location:					
X		0.475			Km
Y		0.152			Km
Z		3			Meters

DATA FOR MIDBLOCK MODEL Time Period: 10:30 - 18:30

Intersection: Beatties Ford/Rozzells Ferry/Trade;(813) X= 0.100 Km;Y= 0.101 Km

Phasing: 4-phase full actuated

(Link) Parameter	Link N(Trde.)	E(Beat.)	S(Trde.)	W(Rozz.)	Units
Approach Link:					
Beg.X	0.111	0.202	0.099	0.020	Km
Beg.Y	0.200	0.197	0.077	0.200	Km
End X	0.100	0.113	0.099	0.081	Km
End Y	0.111	0.109	0.088	0.098	Km
Width	6	6	9	6	Meters
# of Lanes	°	2	2	2	#
Capacity	°	2800	3100	2800	veh/hr.(Level E)
Speed Limit	°	35	35	35	m.p.h.
Volume	°	380	720	320	veh/hr.
Exit Link:					
Beg.X	0.100	0.117	0.089	0.086	Km
Beg.Y	0.111	0.105	0.084	0.100	Km
End X	0.111	0.202	0.092	0.027	Km
End Y	0.200	0.187	0.078	0.200	Km
Width	6	5.5	9	5.5	Meters
# of Lanes	1	2	2	2	#
Speed Limit	35	35	35	35	m.p.h.
Volume	100	420	620	280	veh/hr.
Receptor Location:					
X			0.092		Km
Y			0.011		Km
Z			3		Meters

DATA FOR MIDBLOCK MODEL Time Period: 10:30 - 18:30

Intersection: Fifth/State/Trade (813); X= 0.093 Km;Y= 0.069 Km

Phasing: 4-phase full actuated

(Link) Parameter	Link N(Trde.)	E(Fifth)	S(Trde.)	W(State)	Units
Approach Link:					
Beg.X	0.089	0.138	0.080	0.000	Km
Beg.Y	0.084	0.000	0.000	0.101	Km
End X	0.092	0.107	0.092	0.082	Km
End Y	0.078	0.066	0.049	0.071	Km
Width	9	6	7.5	3	Meters
# of Lanes	2	2	2	1	#
Capacity	3100	2800	3000	1400	veh/hr.(Level E)
Speed Limit	35	35	35	35	m.p.h.
Volume	620	240	460	110	veh/hr.
Exit Link:					
Beg.X	0.099	0.104	0.086	0.082	Km
Beg.Y	0.077	0.057	0.054	0.076	Km
End X	0.099	0.131	0.072	0.000	Km
End Y	0.088	0.000	0.000	0.104	Km
Width	9	6	6	5.5	Meters
# of Lanes	2	2	2	1	#
Speed Limit	35	35	35	35	m.p.h.
Volume	720	210	420	70	veh/hr.
Receptor Location:					
X			0.092		Km
Y			0.011		Km
Z			3		Meters